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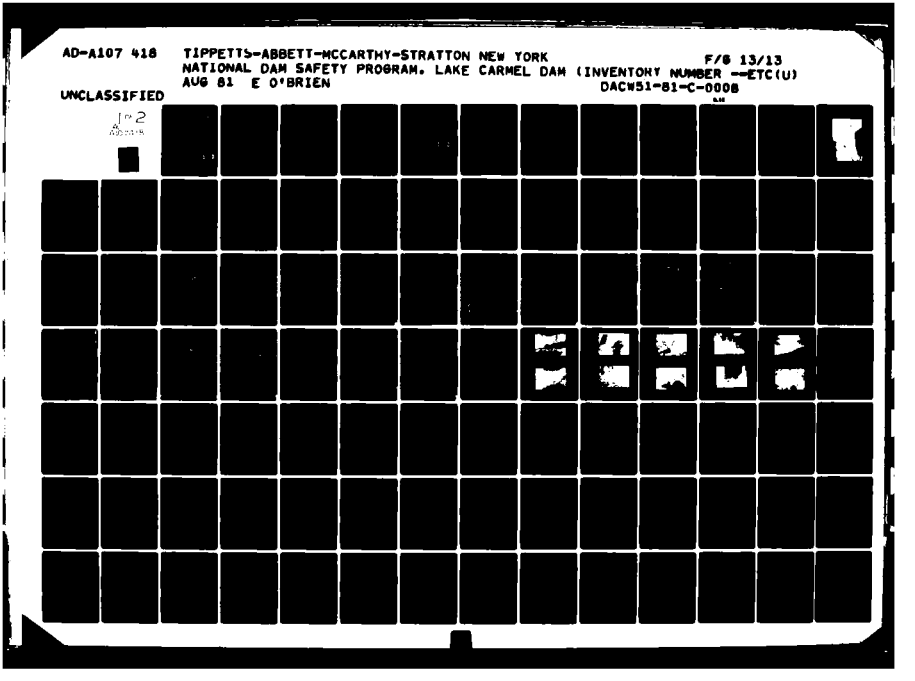

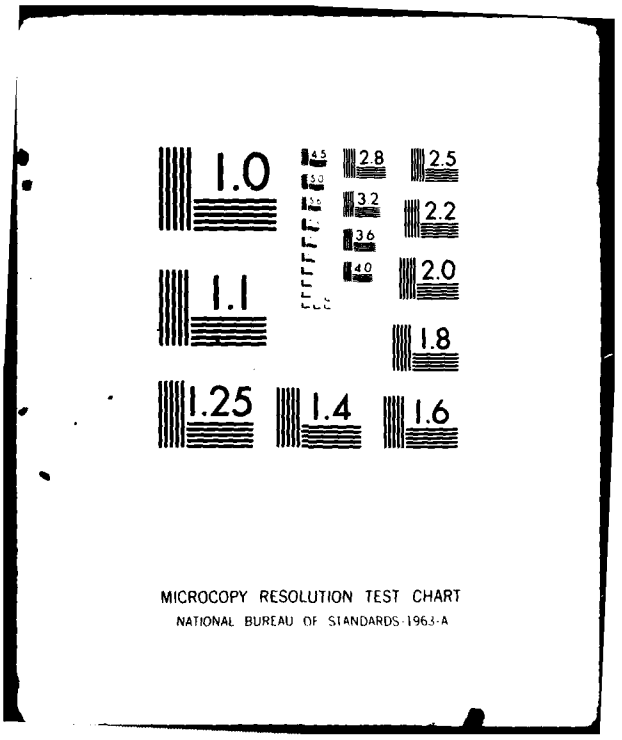
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LEVEL II

LOWER HUDSON RIVER BASIN

LAKE CARMEL DAM

PUTNAM COUNTY, NEW YORK
INVENTORY NO. N.Y. 100

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NEW YORK DISTRICT CORPS OF ENGINEERS

SEPTEMBER 1981

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LOWER HUDSON RIVER BASIN

LAKE CARMEL DAM

PUTNAM COUNTY, NEW YORK
INVENTORY NO. N.Y. 100

PHASE I INSPECTION REPORT
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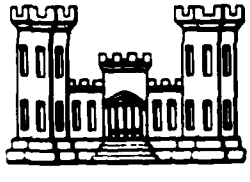

NEW YORK DISTRICT CORPS OF ENGINEERS

SEPTEMBER 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

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18. SUPPLEMENTARY NOTES

Number

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety
National Dam Safety Program
Visual Inspection
Hydrology, Structural Stability
Lake Carmel Dam
Putnam County
Lower Hudson River Basin

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of documents and the visual inspection findings of the dam and its appurtenant structures did not reveal conditions which constitute an immediate hazard to human

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

life and property. However, the dam has some deficiencies which require further investigations and remedial action.

Using the Corps of Engineers' screening criteria for initial review of the adequacy of the service spillway, it has been determined that the structure is inadequate for all floods in excess of 17.5 percent of the Probable Maximum Flood (PMF). Overtopping of the dam could cause breaching the embankment section of the dam: this would significantly increase the hazard of loss of life and property. The spillway section is therefore judged to be "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening and preliminary computations, there appears to be an inadequacy in the service spillway capacity, such that if a severe storm were to occur, overtopping would significantly increase the hazard to life downstream of the dam.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C., 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LAKE CARMEL DAM
I.D. NO. N.Y. 100
D.E.C. NO. 231 - 867
LOWER HUDSON RIVER BASIN
PUTNAM COUNTY, N.Y.

CONTENTS

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	LAKE CARMEL DAM (N.Y. 00100)
STATE LOCATED:	NEW YORK
COUNTY LOCATED:	PUTNAM
STREAM:	MIDDLE BRANCH OF CROTON RIVER
BASIN:	LOWER HUDSON RIVER
DATE OF INSPECTION:	26 MAY 1981

ASSESSMENT

The examination of documents and the visual inspection findings of the dam and its appurtenant structures did not reveal conditions which constitute an immediate hazard to human life and property. However, the dam has some deficiencies which require further investigations and remedial action.

Using the Corps of Engineers' screening criteria for initial review of the adequacy of the service spillway, it has been determined that the structure is inadequate for all floods in excess of 17.5 percent of the Probable Maximum Flood (PMF). Overtopping of the dam could cause breaching the embankment section of the dam: this would significantly increase the hazard of loss of life and property. The spillway section is therefore judged to be "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening and preliminary computations, there appears to be an inadequacy in the service spillway capacity, such that if a severe storm were to occur, overtopping would significantly increase the hazard to life downstream of the dam.

It is therefore recommended that within 3 months from the date of notification to the owner, detailed hydrological/ hydraulic investigations of the structure should be undertaken to more accurately determine the site specific characteristics of the watershed. Analyses should include investigations to

obtain more information regarding the upstream and downstream control facilities and their affect upon the overtopping potential of the dam. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, around-the-clock surveillance should be provided during periods of unusually heavy precipitation and snow melt. At the same time a dam break analysis should be conducted to ascertain flood plain boundaries downstream of the dam and its impact on nearby homes that may be contained within.

The dam has a number of additional deficiences which, if left uncorrected, have the potential for the development of hazardous conditions and must be corrected within 12 months.

1) The active erosional gullies on both the upstream and downstream embankment slopes including the longitudinally traversing drainage near the north abutment on the downstream face should not be permitted to further erode. Existing damage should be repaired.

2) Small trees, shrubs and bushes on both upstream and downstream slopes should be removed with resulting holes and depression properly backfilled and seeded.

3) The gate valve controlling the reservoir drain should be repaired to a good working condition or replaced.

4) Concrete on the spillway training wall should be repaired. Debris and vegetation from the downstream channel should be removed.

5) Foundation for gatehouse should be repaired.

6. Sandbar upstream of spillway channel entrance should be removed.

7. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of moving parts in the reservoir drain system. This program should be documented for future reference. An emergency action plan, described in section 7.1d should be developed and updated periodically during the life of the structure.

Eugene O'Brien, P.E.
New York No. 29823

Approved by:

Col. W. M. Smith, Jr.
New York District Engineer

Date: 13 AUG 1981

1. OVERVIEW OF DAM.

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LAKE CARMEL DAM
I.D. NO. N.Y. 100
D.E.C. NO. 231 - 867
LOWER HUDSON RIVER BASIN
PUTNAM COUNTY, N.Y.

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers Contract No. DACW 51-81-C-0008 in a letter dated 14 December 1980 in fulfillment of the requirements of the National Dam Inspection Act, Public Law 92-367 dated 8 August 1972.

b. Purpose of Inspection

This inspection was conducted to evaluate the existing condition of the dam, to identify deficiencies and hazardous conditions, to determine if these deficiencies constitute hazards to life and property, and to recommend remedial measures where required.

1.2 DESCRIPTION OF PROJECT

a. Description of the Dam and Appurtenant Structures

Lake Carmel Dam consists of a 475 ft long earth embankment having a maximum crest height of 25 feet and a 30 foot crest width. The compacted earthfill embankment according to the existing design records shows a full length (see photograph 1) reinforced concrete core wall located at the upstream crest and extending 2.5 feet into a hard clay foundation stratum. The upstream face is protected by riprap extending from the embankment crest partway down the slope to El 615±. The upstream slope above El 618± ranges between 1V:1.5H and 1V:2.0H; it flattens to 1V:2.5H below El 618±. Downstream slopes are uniform and range between 1V:1.5H and 1V:2.0H. The crest serves to support an asphalt paved town road.

The service spillway (see photograph 2) located at the south abutment, is a reinforced concrete rectangular open channel section 70 feet in width. Crest elevation of the apron is 5 feet below the crest of the dam. A reinforced concrete curvilinear chute feeds a reinforced concrete apron directing water to the discharge channel (Middle Branch of the Croton) at

the toe of the dam.

The dam is equipped with a reservoir drain system in the form of a 4x4 ft reinforced concrete pipe section passing through the base of the structure. Flow in this drain is controlled by means of a sliding gate valve operated from a gate house located near the upstream embankment crest.

b. Location

The dam is located approximately 2 miles north east of Carmel, in the City of Lake Carmel, Putnam County, New York.

c. Size Classification

The dam is 25 feet high and has a reservoir at this height with a storage capacity of 1620 acre-feet and, therefore, is classified as an Intermediate Dam.

d. Hazard Classification

The dam is in the "high" hazard potential category due to the location of occupied residences located downstream and within the flood plain.

e. Ownership

Present ownership of the dam is unclear. Its original ownership reported in the Application for Construction is the Town of Kent Park District. Past records regarding maintenance of the dam indicate continued involvement on behalf of the Town of Kent Park District thru 1958.

f. Purpose

The dam was constructed to form Lake Carmel for recreational use. No other use of the Lake is permitted.

g. Design and Construction History

The dam was designed by Messrs. W. J. Kaufman, W. Wickstrom, and P. H. Brown, address unknown, in February 1930 as indicated on the original design drawings presented in Appendix A. The exact construction date of the structure is unknown. Construction of the structure appears to generally conform with the original design with the exception of a concrete parapet wall which apparently was never built.

h. Normal Operation Procedure

Discharge is uncontrolled through the service spillway. There appears to be no normal operating procedure established

for the reservoir drain.

1.3 PERTINENT DATA

a. Drainage Area, square miles 13.0

b. Discharge at Dam Site, cfs

Uncontrolled Service Spillway at Max. Pool	2830 cfs
Reservoir Drain at Max. Pool (El. 623.37)	Unknown
Total Discharge at Max. Pool (El. 623.37)	2830+cfs

c. Elevations, USGS Datum MSL

Crest of Dam	623.37*
Maximum Design Pool	622.37*
Spillway Crest	618.37*
Invert Reservoir Drain	599.24*

d. Reservoir

Length of Maximum Pool, feet	8400
Surface Area @ Maximum Pool, Acres	240

e. Storage, Acre-feet

Reservoir at Spillway Crest	1620
Reservoir at Maximum Pool	2790

f. Dam

Type	Earthfill with Reinforced Concrete core wall cut off
Height, feet	25
Length, feet	475
Upstream Slope	1V:1.5H to 1V:2.0H above El.618± 1V:2.5H below El. 618±
Downstream Slope	1V:1.5H to 1V:2.0H
Crest Elevation, feet	623.37*
Crest Width, feet	30
Cut off type	Reinforced concrete wall
Grout Curtain	None

g. Spillway

Type	Reinforced Concrete Rectangular Open Channel with Curvilinear Chute and Apron Structure.
Length, feet	50
Crest Elevation, feet	618.37*
Width, feet	70
Flow Regulation	Uncontrolled

* Based on original design drawings

h. Reservoir Drain

Type	Concrete Box Culvert
Dimensions	4.0' x 4.0' I.D.
Flow Regulations	Sliding Gate Valve

SECTION 2 - ENGINEERING DATA

2.1 GEOLOGY

The Lake Carmel Dam is located in the Hudson Highlands Section of the New England Maritime Physiographic Province. The bedrock in the area consists of methomorphic, igneous and sedimentary rocks which have undergone a complex sequence of position, folding, faulting and erosion. In the vicinity of the damsite, bedrock consists of biotite-quartz-plagioclase paragneiss.

2.2 SUBSURFACE INVESTIGATIONS

There is no record of subsurface investigation for the dam. Shallow surficial soils along the dam alignment are presumed to be alluvial deposits associated with the Middle Branch of the Croton River whereas underlying soils projected as hard clays or hardpan would be of glacial origin.

2.3 DAM AND APPURTENANT STRUCTURES

The original design drawings for the Lake Carmel Dam are presented in Appendix A.

2.4 CONSTRUCTION RECORDS

No information regarding the construction of the dam and its appurtenant structures is available. The dam was reportedly built circa 1930.

2.5 OPERATION RECORDS

The dam is for the sole purpose of containing Lake Carmel. Limited records of operation or maintenance (primarily a series of 1958 correspondence) exist. Reportedly both the Town of Kent and Putnam County Highway Departments have provided some maintenance to the dam, primarily associated with the road located at the crest. Discussions with representatives of both the Town of Kent and Putnam County did not provide sufficient information to establish present ownership or maintenance responsibility for the dam.

No systematic monitoring of the dam's performance is in effect at this time.

2.6 EVALUATION OF DATA

The information obtained from the available documents and a visual inspection are sufficient to support a Phase I evaluation of the dam.

SECTION 3 VISUAL INSPECTION

3.1 FINDINGS

a. General

The visual inspection of Lake Carmel Dam was made on May 26, 1981. The skies were clear with temperatures ranging from 75 to 85°F. The reservoir level was estimated to be at El. 618.5 based on a water depth of about 2 inches at the spillway crest.

b. Embankment Structures

The embankment structure is generally in good condition showing no signs of horizontal or vertical movement, general instability or seepage. Of major concern, however, are several well developed erosional gulleys both on the downstream and upstream embankment faces. These gulleys appear to be developed along pedestrian access routes down the slope (see photographs 3 & 4).

Additionally the following adverse conditions were noted:

1) Moderately heavy vegetation, including deciduous trees, shrubs and bushes, is present on both the upstream and downstream slopes (see photographs 1 & 5).

2) The gate valve controlling the reservoir drain is not in good working condition and leaks in its closed position.

3) A minor drainage channel longitudinally traversing the downstream slope near the North Abutment exists (see photograph 6).

4) Rip rap is disturbed or absent in isolated areas along the upstream slope (see photographs 7 & 8).

5) The Gatehouse masonry foundation is severely cracked with stones missing (see photographs 8 & 9).

6) There is no emergency action plan for the project.

c. Spillway

Training walls both upstream and downstream are cracked with some spalling. A major crack on the southern downstream wall (see photograph 10) was reportedly repaired but needs further attention. At present the wall appears stable, showing no signs

of recent movement either rotational or translational. Apron slabs are cracked most notably at the junction with the north training wall where water is flowing beneath the slab causing erosion at the slab toe (see photograph 11).

d. Downstream Spillway Channel

The spillway apron discharges into a short natural channel emptying into the Middle Branch of the Croton River. The channel contains moderately heavy vegetation near the center. In addition, there is some debris in the spillway channel.

e. Reservoir Drain Channel

Discharges from reservoir drain are directly into the course of the Middle Branch of the Croton River. Fill extending into the river has resulted in constricting its flow forming a pool in the general vicinity of the outlet.

f. Abutments

The dam abutment areas are in good condition. There does not appear to be either instability or seepage problems in these areas.

g. Reservoir Area

No slides or general instability were observed along the reservoir shoreline in the general vicinity of the dam. No significant sedimentation was observed along the dam; however, a sandbar was building near the entrance of the service spillway.

3.2 EVALUATION OF OBSERVATIONS

Although deficiencies were observed, there is no indication that the dam is in imminent danger. Some of the deficiencies noted previously are minor and should be corrected in conjunction with routine maintenance. Other conditions described, however, represent conditions which may present potential for further deterioration and consequently need further investigation and correction.

The following is a summary of the problem areas encountered and recommended corrective measures requiring immediate attention:

1) The reservoir drain gate valve should be repaired to good working condition or suitably replaced.

2) Major cracks in the service spillway should be filled and monitored. Training walls should be properly backfilled.

3) Repair erosional gulleys by filling with properly compacted earthfill following by seeding.

4) Control of surface water drainage longitudinally traversing the downstream slope from the north abutment by construction of a positive drainage system.

5) Vegetative growth in the spillway discharge channel as well as all debris should be removed.

6) Fill constricting flow from the pool at the reservoir drain discharge should be removed.

7) Foundation walls for the gate house should be reconstructed.

8) Removal of small trees (less than 8" diameter), brush and shrubs from embankment slopes and proper backfilling of resulting depressions or holes with subsequent seeding should be performed. Removal of larger trees may be difficult because of the more extensive root networks and therefore is not recommended, however, these trees should be inventoried and monitored for seepage near the root ball.

9) A program of periodic inspection and maintenance of the dam and appurtenances including yearly operation and maintenance of the reservoir drain and its control facilities should be developed and implemented. Inspections should be documented for future reference. Also, an emergency action plan should be developed.

SECTION 4 - OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

No written operation and maintenance procedures exist for the project. The normal operation is to allow flow through the service spillway.

4.2 MAINTENANCE OF DAM

It is reported that no routine maintenance of the dam is performed.

4.3 WARNING SYSTEM IN EFFECT

No warning system is in effect or in preparation.

4.4 EVALUATION

The overall condition of the dam and appurtenant structures appears to be good. Recommendations in connection with regular maintenance are discussed in Section 7.

SECTION 5 - HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE BASIN CHARACTERISTICS

The Lake Carmel Dam is located on the upstream reaches of the Middle Branch of the Croton River in the City of Lake Carmel, southeast of Kent Township, Putnam County, New York (Hydrologic Unit Code 02030101). The drainage basin extends north into Dutchess County with an area of 13 sq. miles. The upper drainage basin is rural with a combination of steep hills and low lying marsh lands. The major tributary drainage in this area is Stump Pond Stream passing through a series of small ponds among which Stump Pond is the largest. The lake occupies approximately 3 percent of the total drainage area. In the vicinity of Lake Carmel, about 1.4 sq. miles of area is thickly populated.

5.2 ANALYSIS CRITERIA

The analysis of the service spillway capacity was performed by developing a design flood using the unit hydrograph method and the Probable Maximum Precipitation (PMP). The all season PMP for 200 square miles in 24 hours for the Lake Carmel area is 22 inches as reported in the Weather Bureau's Hydrometrological Report No. 33 and distributed over 48 hours. Inflow hydrograph from the entire basin is computed by using the U. S. Army Corps of Engineers HEC-1DB computer program. For unit hydrograph computations, the Snyder coefficients C_t and C_p are assigned as 2 and 0.625 respectively. An initial loss of 1.0 inch and constant loss of 0.1 inch/hour were estimated as representative of the basin for the design storm.

In accordance with the recommended guidelines for Safety Inspection of Dams, the adequacy of the spillway is analysed using the PMF. A multi-plan analysis was performed for the full, 0.75, 0.50 and 0.25 PMF.

In order to evaluate the tailwater elevation at the dam, the outflow from the reservoir was routed to a cross-section downstream of the dam. This cross-section was obtained from field observation and the USGS topographic map, Lake Carmel quadrangle.

5.3 SPILLWAY CAPACITY

The ungated concrete spillway, crest elevation at 618.37 ft (MSL), is 70 ft in width with the sidewalls being used to support a bridge deck completing the roadway atop the dam. A 1.5 ft wide pier used as a center support for the bridge deck is located at the center of the spillway. Therefore, the effective width of the spillway is 68.5 ft. The opening between the crest and the

bridge, partialy restricted by the bridge deck support, is 3.5 ft. As the water surface elevation rises from the spillway crest to the bottom of bridge substructure, the spillway was assumed to act as a broad crested weir. When the water surface elevation exceeded the level of bridge bottom, flow through the opening was computed by using an orifice flow formula. The computed maximum discharge with the water surface elevation 623.37 ft (top of dam/bridge) is 2,830 cfs.

5.4 RESERVOIR CAPACITY

The normal reservoir capacity is listed as 1620 acre feet. This capacity is assumed to be equal to the storage when water surface elevation is at the spillway crest. The surcharge storage of 1170 acre feet computed for a water surface elevation at 623.37 ft (top of dam/bridge) is equivalent to approximately 1.69 inches of runoff over the entire basin.

5.5 FLOODS OF RECORD

No record of flood or maximum lake elevation is available; however, the dam has reportedly never been overtopped.

5.6 OVERTOPPING POTENTIAL

The potential of the dam being overtopped was investigated based on the spillway discharge capacity and the available surcharge storage to meet the selected design flood inflows. The computed PMF, routed through the lake resulted in a maximum lake level at elevation 627.43 feet, 4.06 feet above the dam crest. and a maximum peak outflow of 16,198 cfs. Lake elevation was assumed to be at 618.37 (spillway crest elevation) at the beginning of the flood event. Table 1 is the summary of the multi-ratio analysis.

TABLE - 1

Ratio of PMF(%)	Inflow Peak (cfs)	Outflow Peak (cfs)	Overtopping (Ft.)
100	16,718	16,198	4.06
75	12,538	12.086	3.14
50	8,359	7,802	2.02
25	4,179	3,170	0.29

The analysis indicates that the spillway is capable of passing only 17.5 percent of the PMF before overtopping occurs.

5.7 EVALUATION

The Lake Carmel Dam spillway is capable of discharging only 17.5 percent of the PMF without the dam being overtopped. Overtopping could result in the failure of the dam thus significantly increasing the hazard to the loss of life downsteam. Therefore the spillway is assessed as "seriously inadequate."

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Visual inspection of the dam did not indicate instability of the embankment from either seepage or a general slope type failure. Although not posing an immediate threat to the structural integrity of the embankment at its present operating level, several adverse conditions were observed that if allowed to further deteriorate and/or if subjected to flood stage loading may seriously jeopardize stability of the dam. As detailed in Section 3, erosion of both the upstream and downstream embankment slopes, if allowed to continue, could develop into an eventual breaching of the dam. Similarly, continued undermining of the spillway apron will undercut the slope and may progressively develop into a general slope failure.

b. Design and Construction Drawings

A review of original design drawings does not reveal any structural stability problems or sources for potential problems.

c. Operating Records

There are no operating records for the dam.

d. Post Construction Changes

There are no reported post-construction changes to the dam. Some repair work to fill a cracked training wall in the spillway was reportedly performed in 1958.

e. Stability Analysis

Stability analysis of the open channel spillway section were not performed to evaluate either sliding or overturning. With consideration for the minimal loads applied to the uncontrolled spillway structure when compared to its relative size and mass it can be intuitively concluded that the stability criteria set forth by the COE will be met under the severest of loading conditions.

f. Seismicity Stability

The dam is located in Seismic Zone 1 and in accordance with recommended Phase I guidelines does not warrant seismic analyses.

SECTION 7 - ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

Examination of the available documents and a visual inspection of the dam and the appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial action.

Using the Corps of Engineers' screening criteria for review of spillway adequacy, it has been determined that the dam would be overtopped for all storms exceeding approximately 17.5 percent of the Probable Maximum Flood (PMF). The overtopping of the dam could result in a failure of the embankment and abutments thus increasing the hazard to loss of life downstream. The spillway is, therefore, adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downsteam from the dam.

The structural stability based on a review of available information and visual inspection indicates that the embankment and spillway structures are adequate in this regard.

b. Adequacy of Information

The information and data available were adequate for performance of this investigation. However, prior to the initiation of the following recommended additional investigations and corrective measures, the establishment of present ownership and maintenance responsibility is of paramount importance.

c. Need for Additional Investigations

A detailed hydrological/hydraulic investigation of the structure should be undertaken to more accurately determine the site specific characteristics of the watershed. Analyses should include investigations to obtain more information regarding the

upstream and downstream control facilities and their effect upon the overtopping potential and stability of the dam.

d. Urgency

The additional hydrologic / hydraulic investigations which are required must be initiated within 3 months from the date of notification. Within 12 months of notification, remedial measures as a result of these investigations must be initiated, with completion of these measures during the following year. In the interim, an emergency action plan for the notification of downstream residents and proper around-the-clock surveillance of the dam during periods of extreme runoff should be developed. The other problem areas listed below must be corrected within one year from notification.

7.2 RECOMMENDED MEASURES

1. The results of the aforementioned investigation will determine the appropriate remedial measures required regarding spillway modifications.

2. Repair erosional gullies on embankment slopes.

3. Repair the concrete apron at the toe of the embankment and clean out downstream channel.

4. Excavate constricting fill downstream of the reservoir drain outlet structure.

5. Repair or replace reservoir drain outlet gate valve to a good working condition.

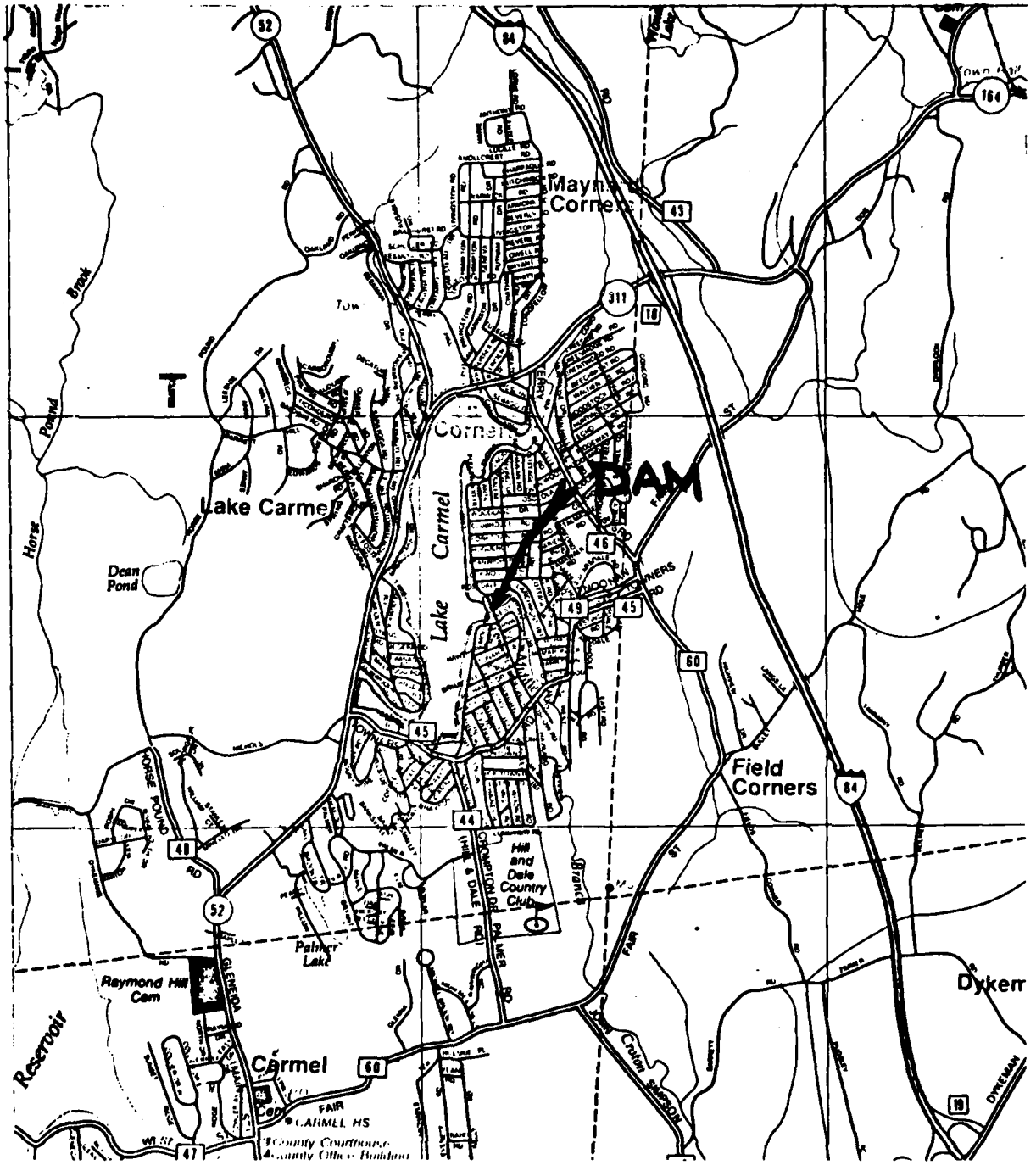
6. Repair gate house foundation.

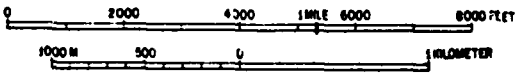
7. Remove developing sandbar at entrance to spillway.

8. Provide a program of periodic inspection and maintenance of the dam and appurtenance including yearly operation and lubrication of the reservoir drain and its control facilities. Document this information for future reference. Establish an emergency action plan and maintain and update it periodically during the life of the structure.

DRAWINGS

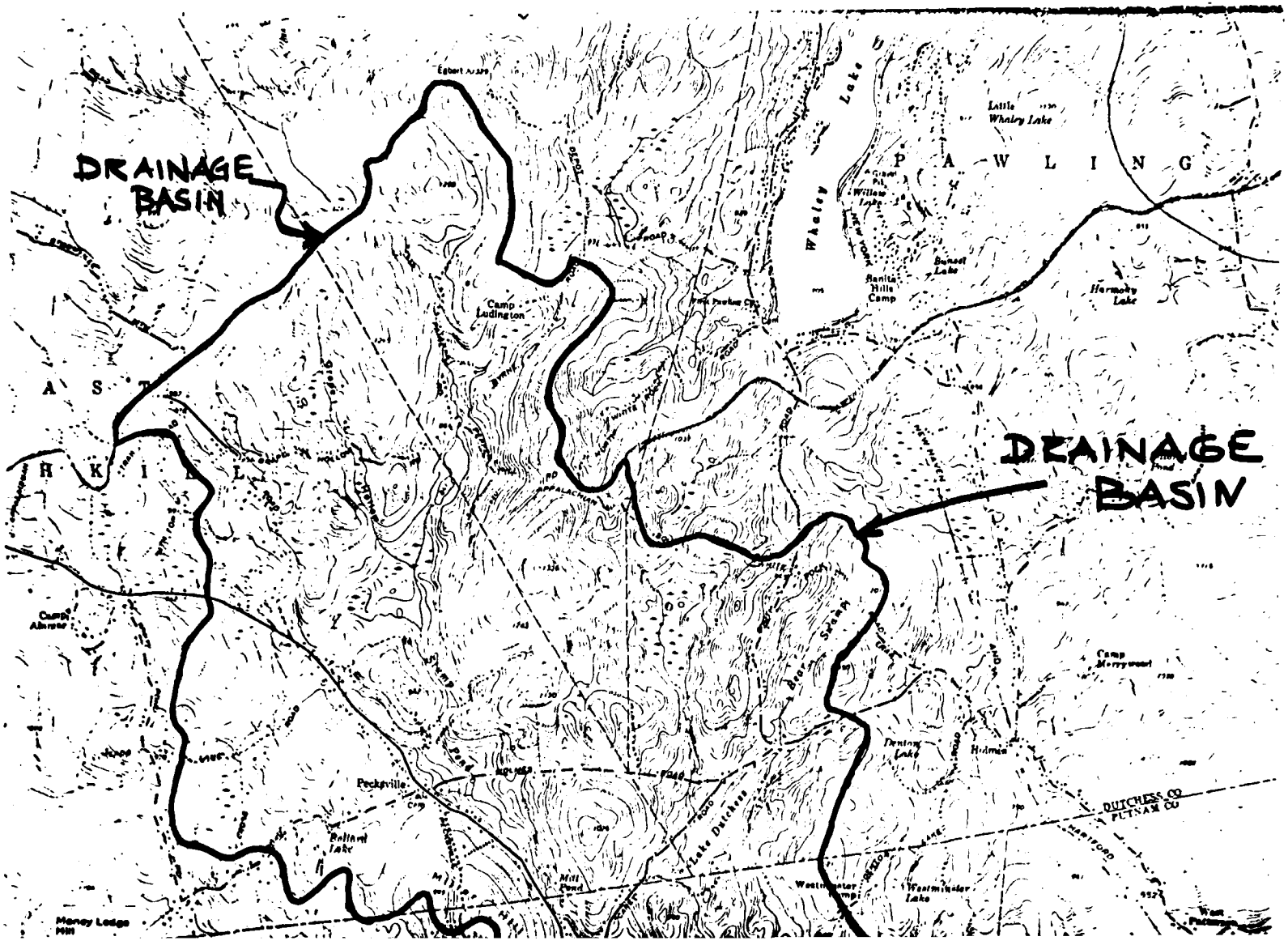
APPENDIX A



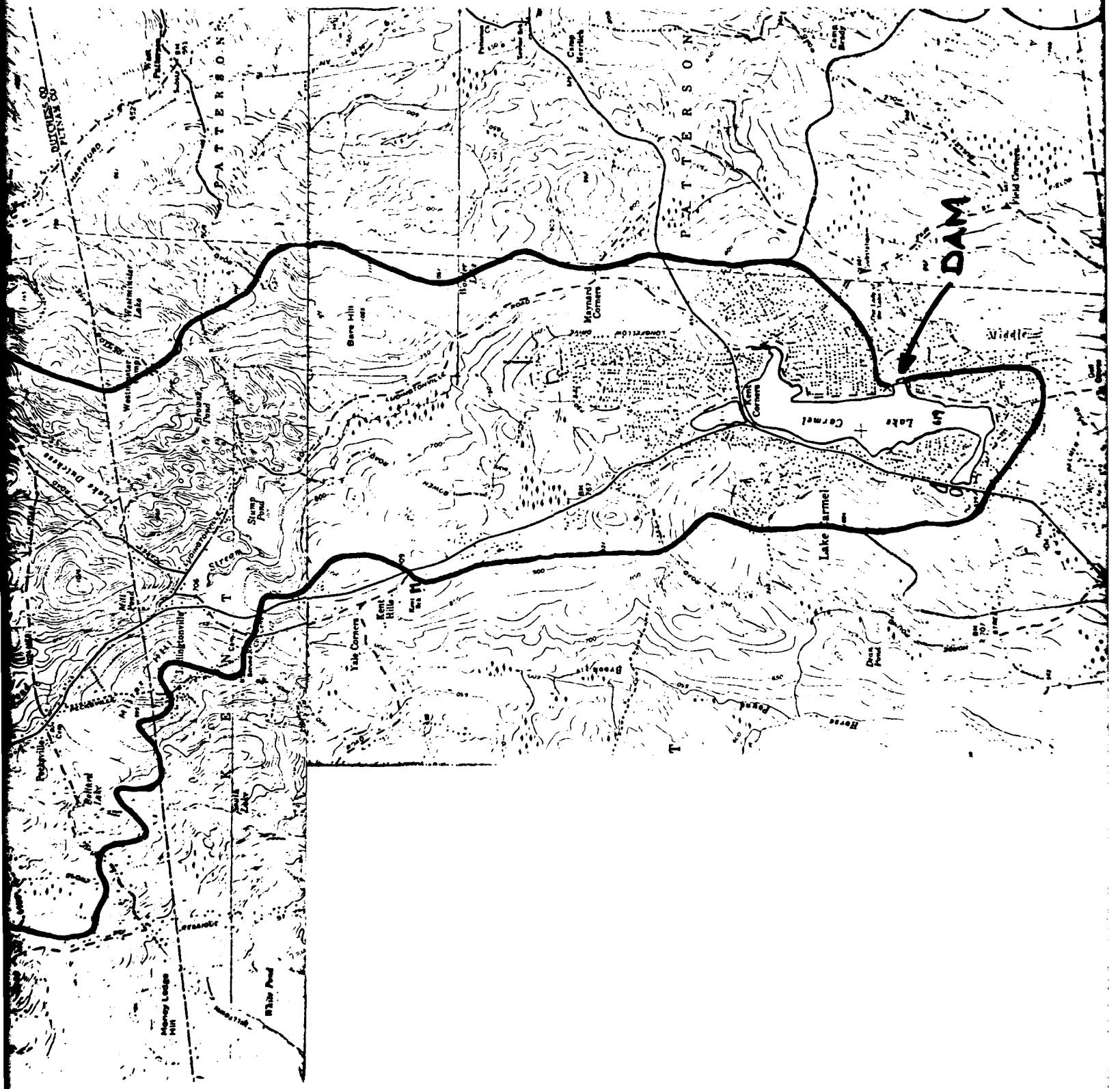


VICINITY MAP
LAKE CARMEL DAM

PLATE NO. 1


DRAINAGE BASIN
DRAINAGE BASIN
P A W L I N G
A S T
H K I L L
Wiley Lake
Little Whaley Lake
Camp Ludington
Ranita Hills Camp
Harmony Lake
Camp Alamac
Pecksville
Camp
Bullard Lake
Mill Pond
Lake Dutchess
Deuel Lake
Holmes
Camp Merrywood
DUTCHESS CO
PUTNAM CO
Westminster Camp
Westminster Lake
Money Lodge Hill

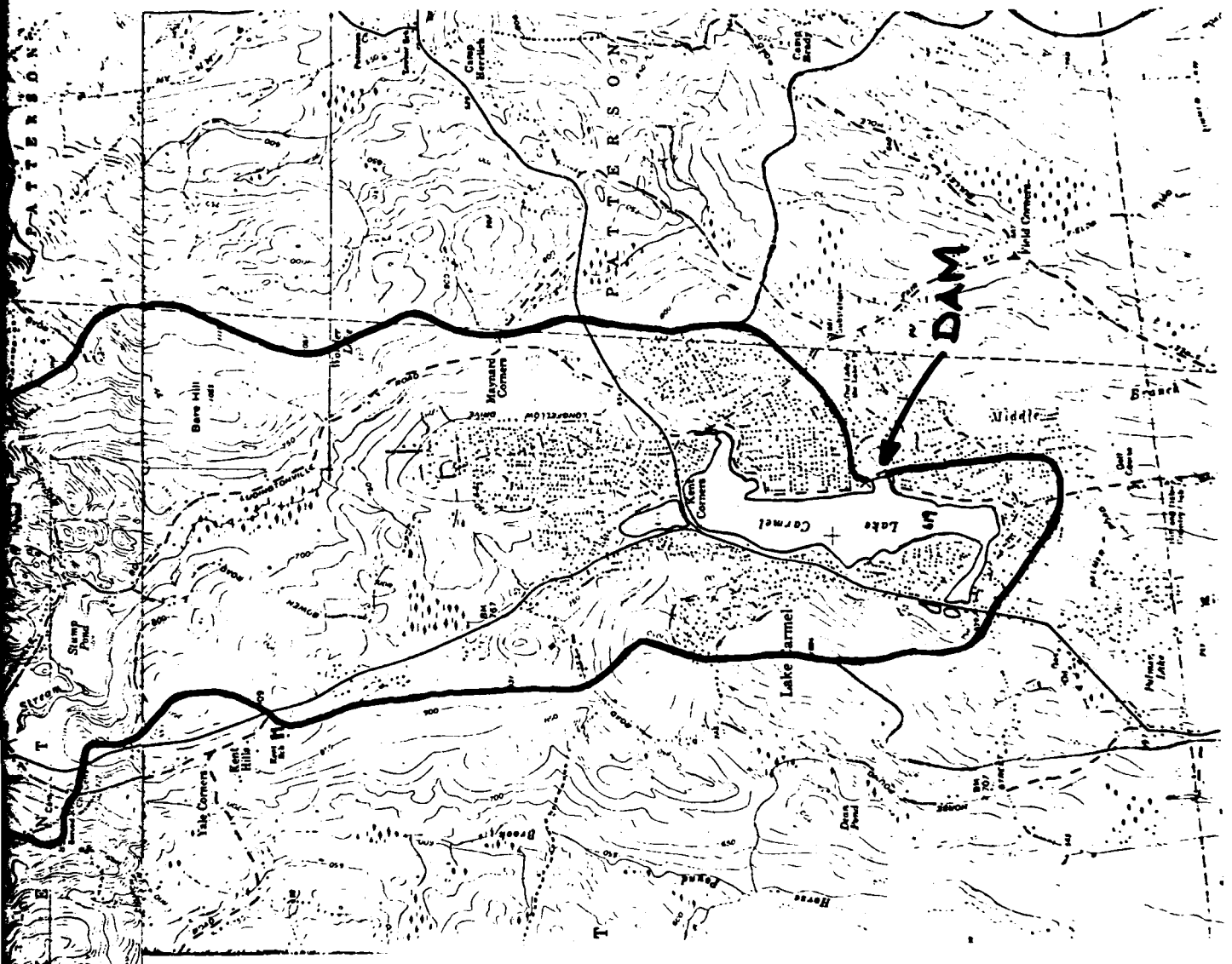
LAKE CAMEL,
POUGHQUAG, N



TOPOGRAPHIC MAP
LAKE CARMEL DAM

LAKE CAMEL, N.Y.

POUGHQUAG, N.Y.

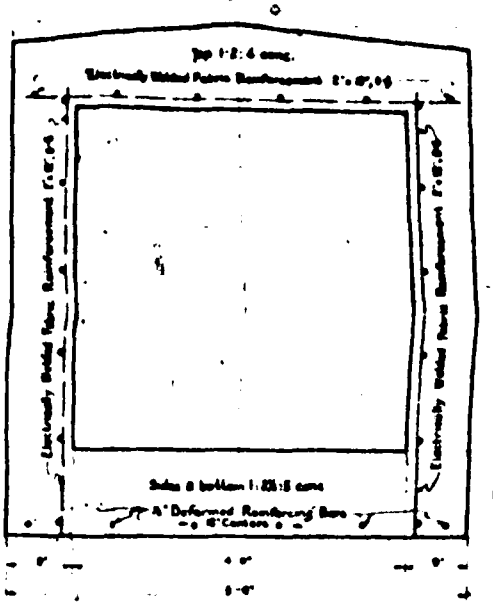


TOPOGRAPHIC MAP
LAKE CARMEL DAM

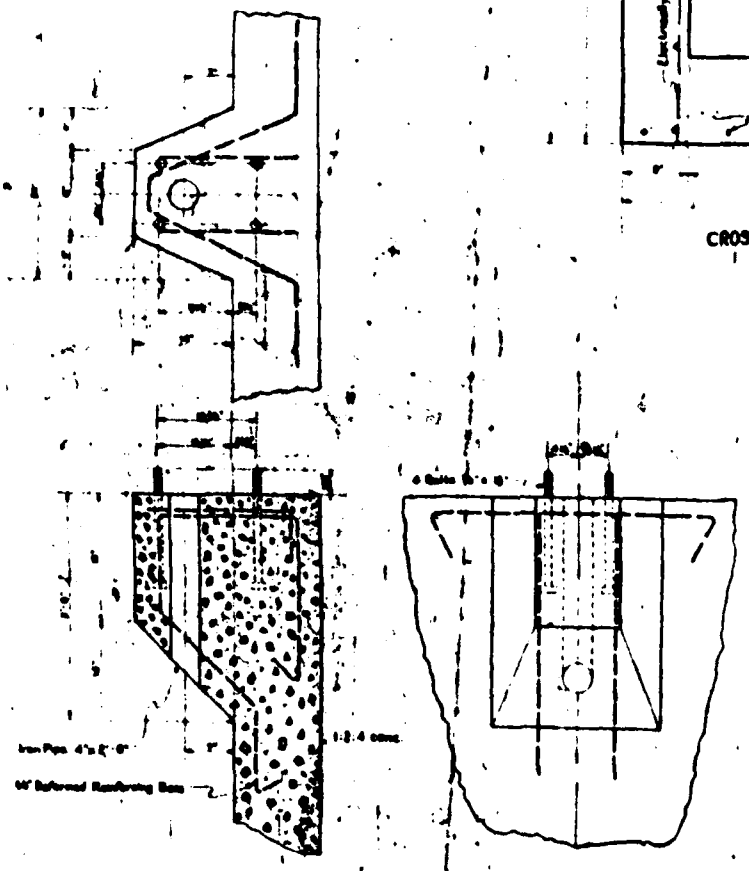
2

3

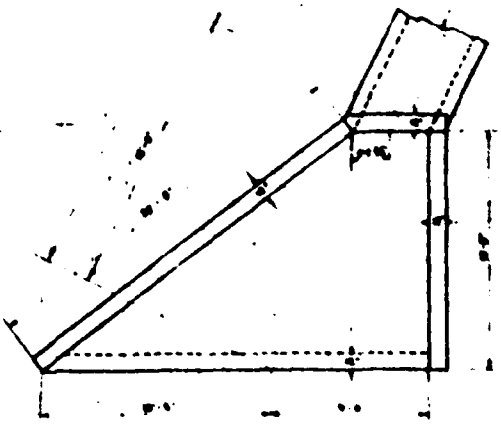
PLATE NO.

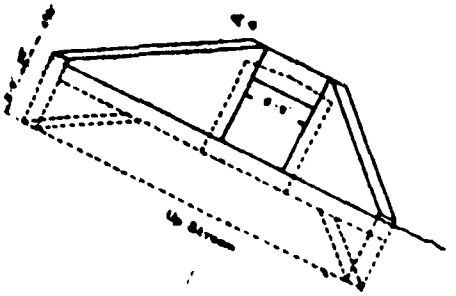


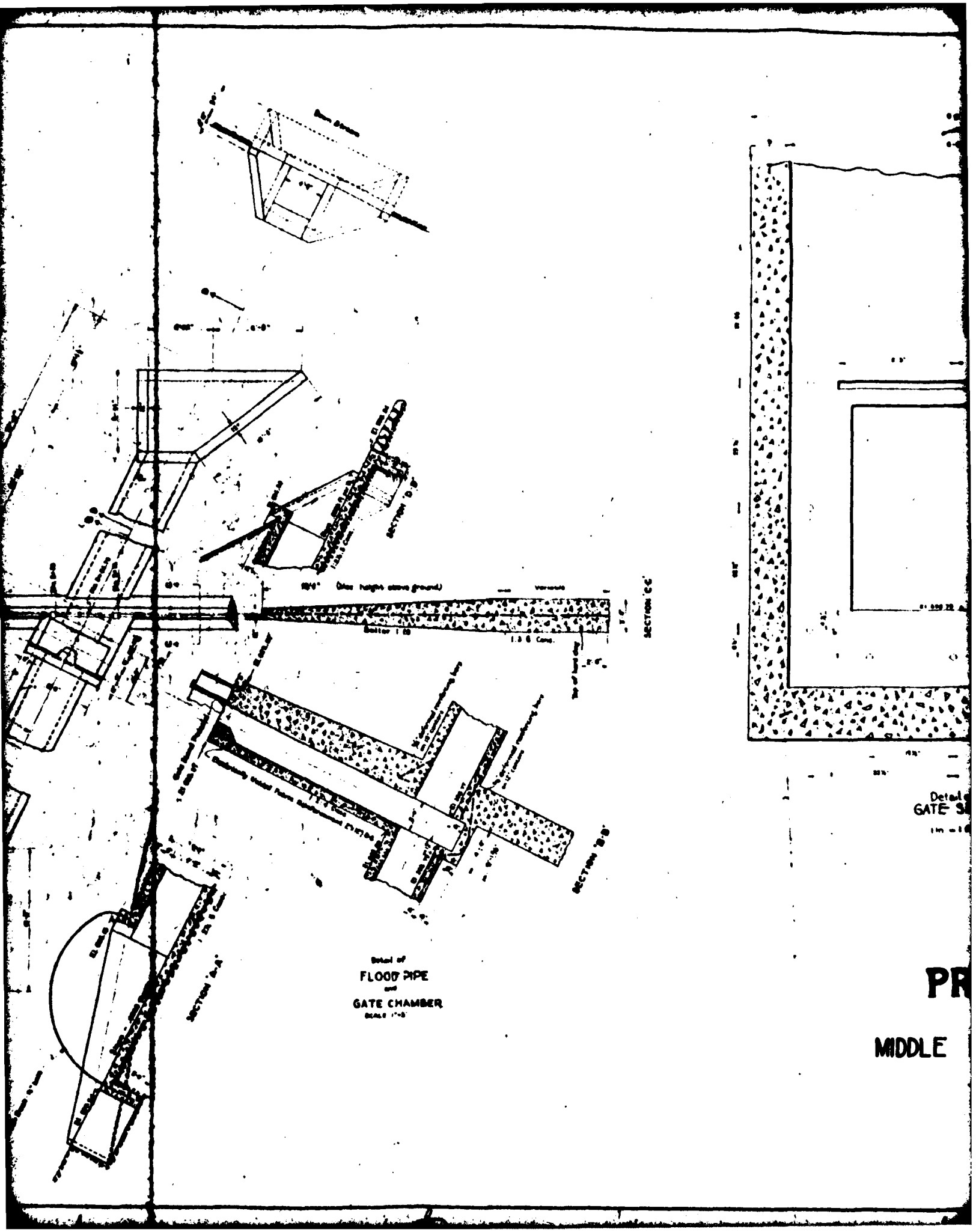
CROSS SECTION OF FLOOD PIPE

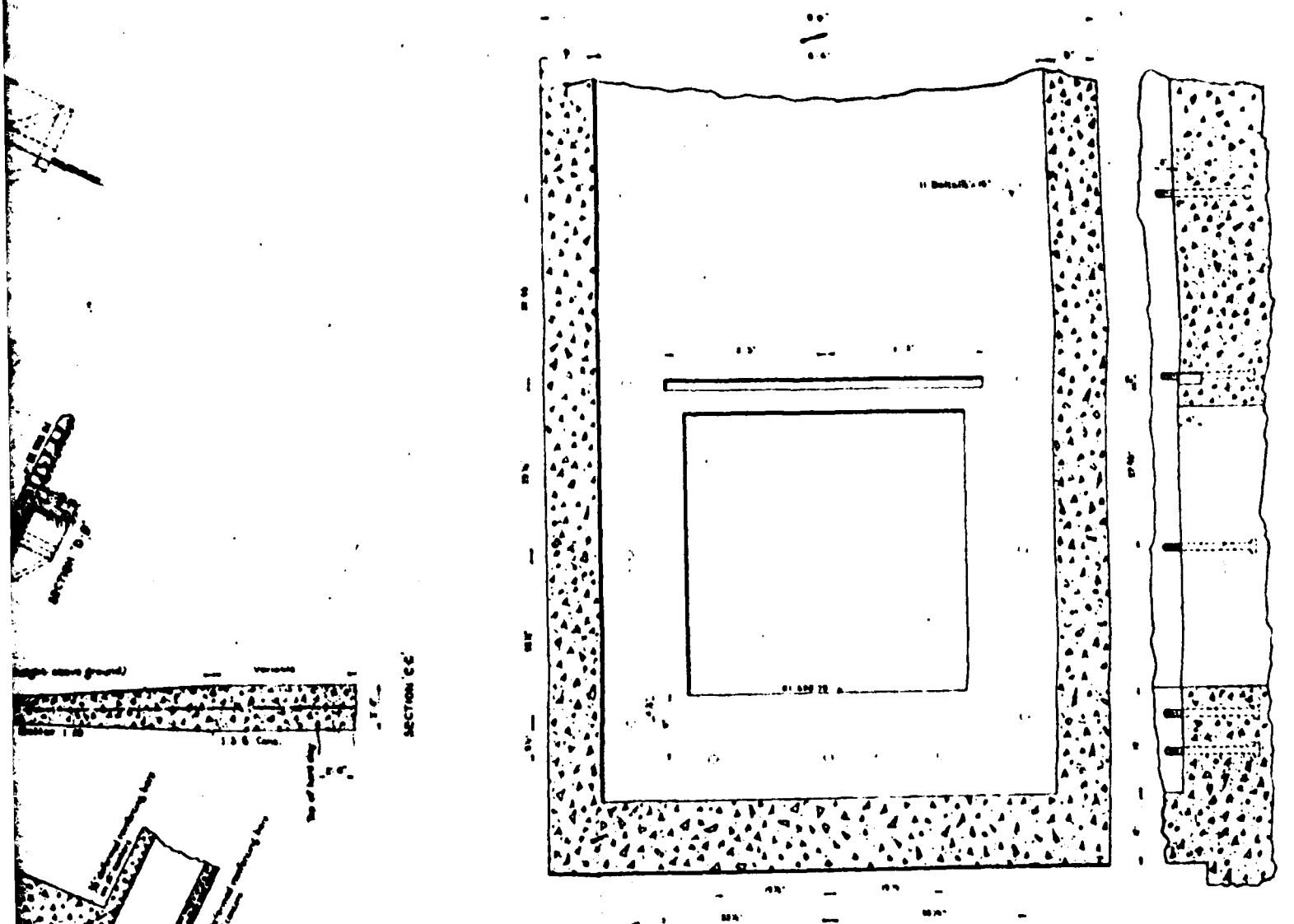


Detail of
GATE STAND PEDESTAL






SECTION 'C-C'
SECTION 'D-D'
SECTION 'E-E'
SECTION 'A-A'
SECTION 'B-B'
Detail of
FLOOD PIPE
and
GATE CHAMBER
Detail
GATE S
PR
MIDDLE



Detail of
GATE SEAT

Detail of
FLOOD PIPE
and
GATE CHAMBER

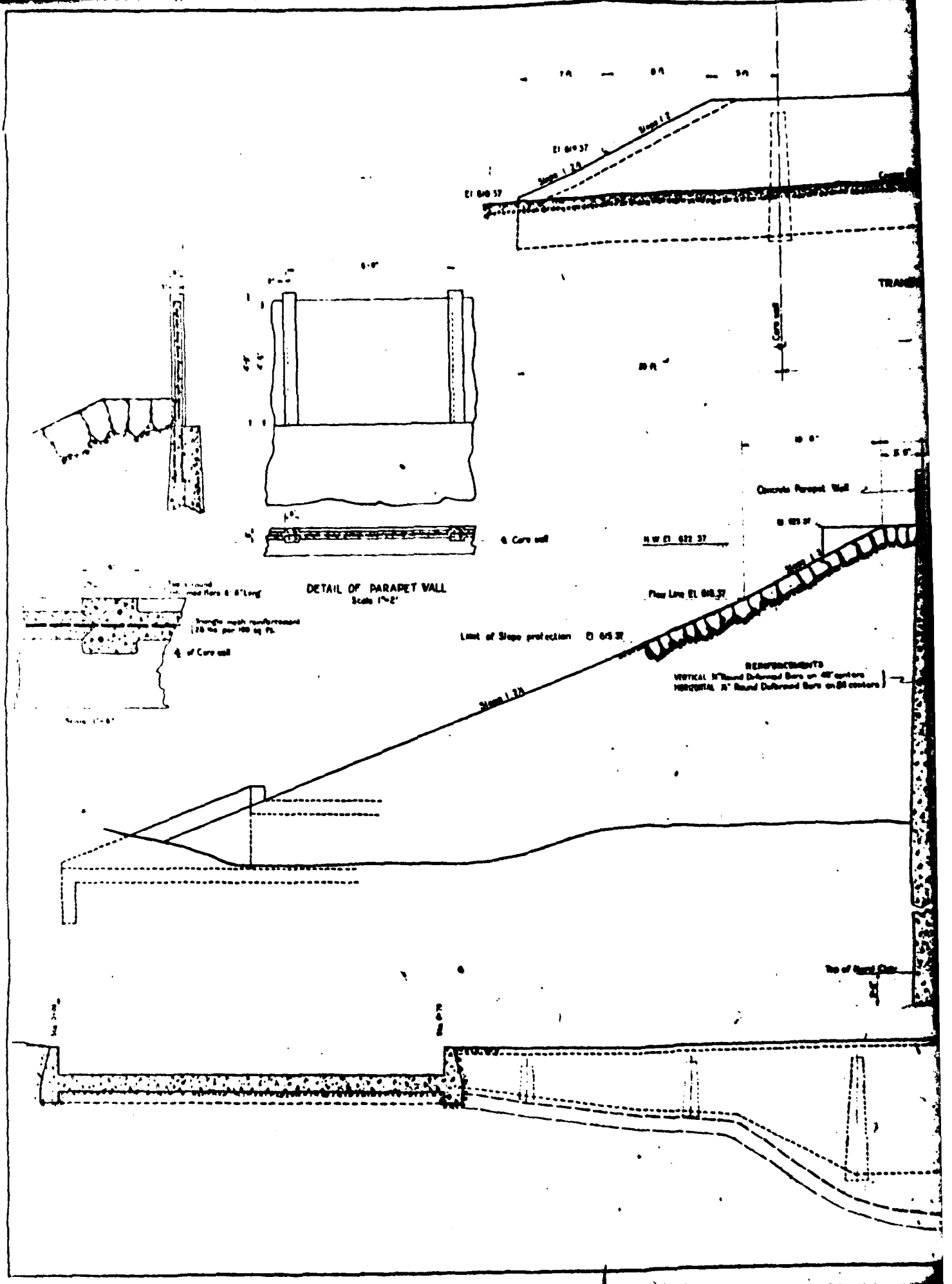
PLAN OF

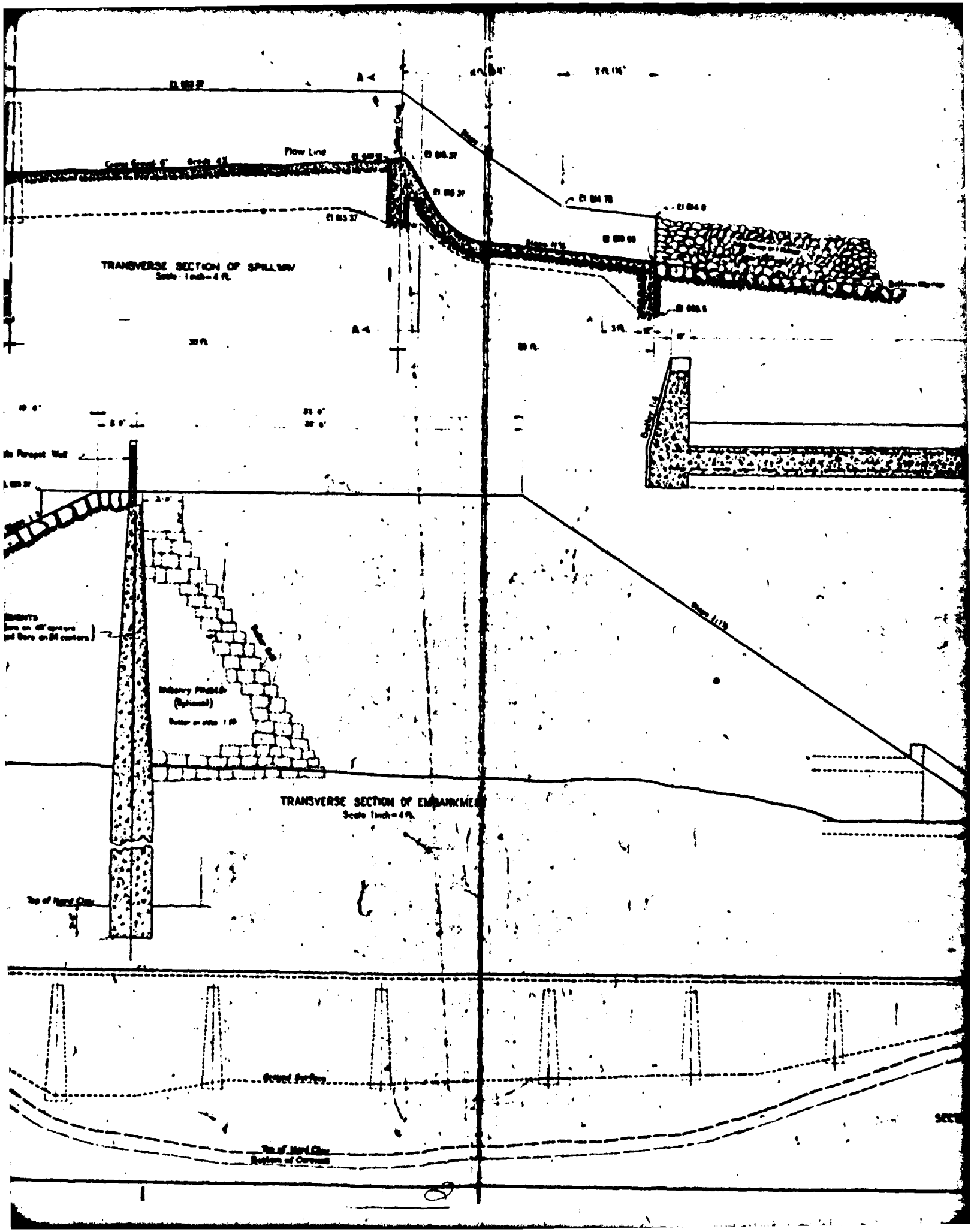
PROPOSED DAM

across the

MIDDLE BRANCH OF CROTON RIVER

near Carmel
PUTNAM CO. N.Y.


DETAIL OF PARAPET WALL
Scale 1"=2'
Concrete Parapet Wall
Limit of Slope protection
Flow Line
REINFORCEMENTS


Flow Line
TRANSVERSE SECTION OF SPILLWAY
Scale 1 inch = 4 ft.
TRANSVERSE SECTION OF EMBANKMENT
Scale 1 inch = 4 ft.
Ground Surface
Top of Hard Clay
Bottom of Cutoff

PLAN OF

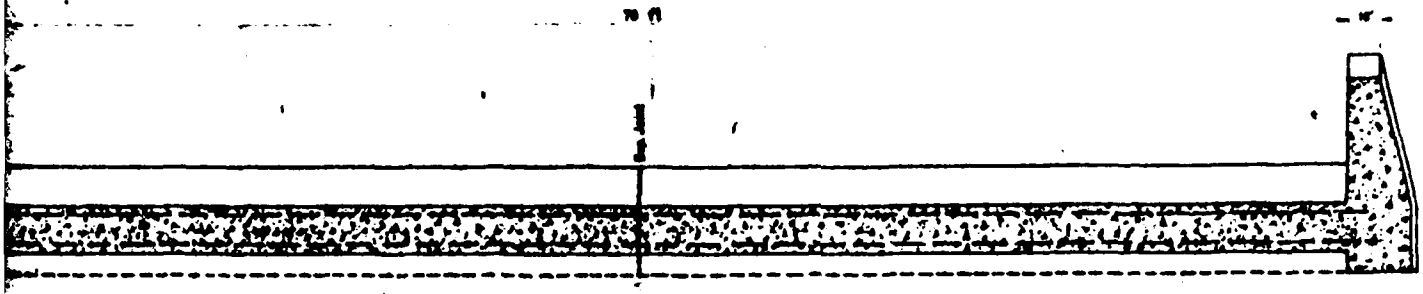
PROPOSED DAM

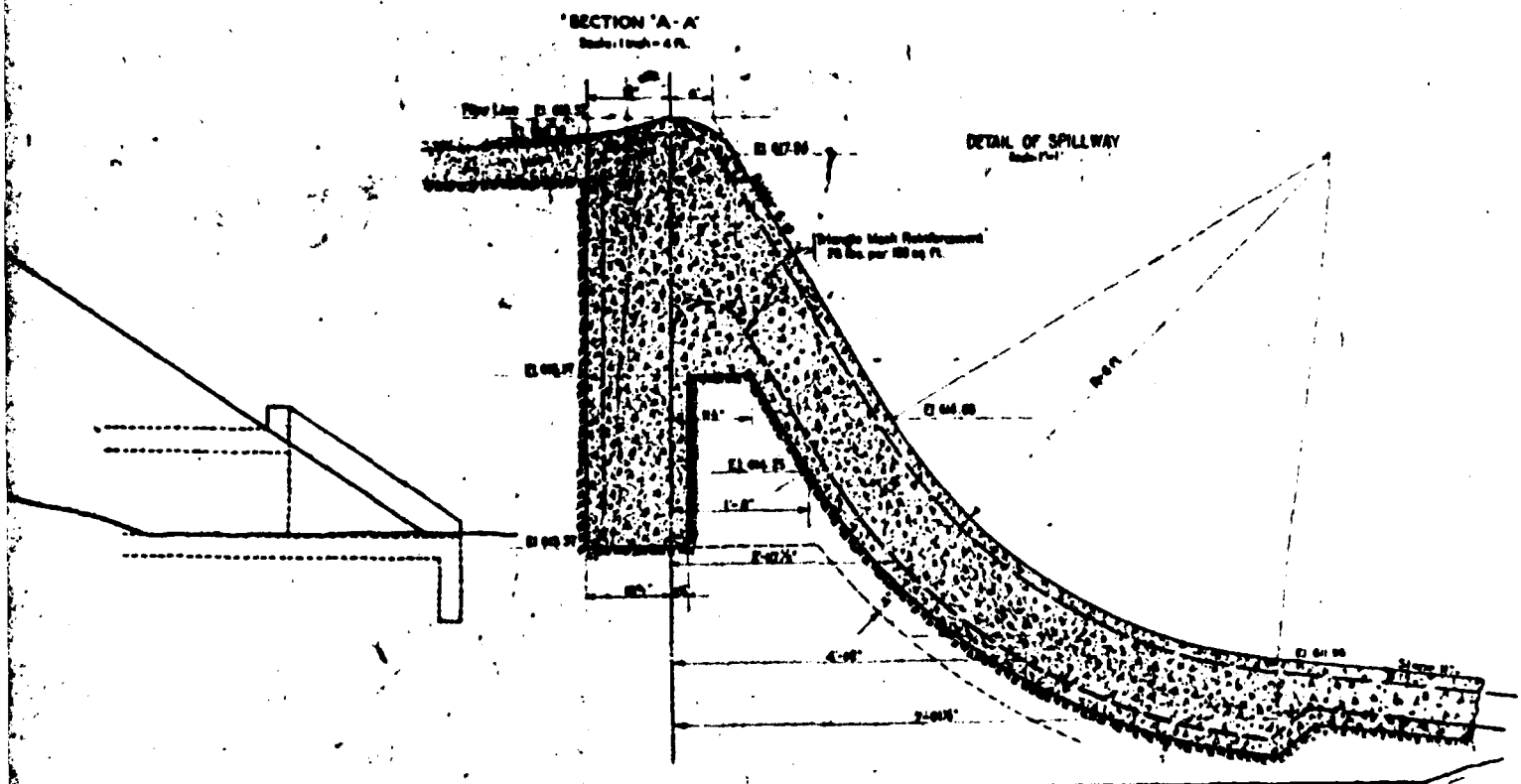
across the

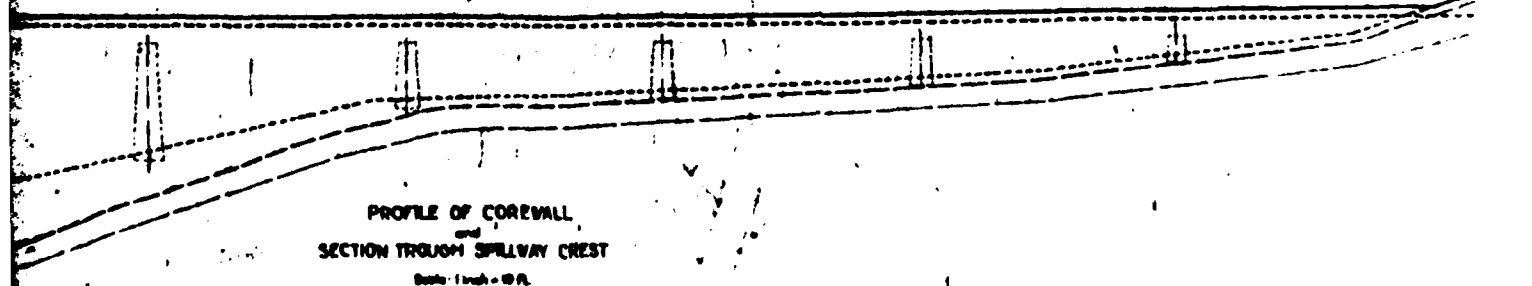
MIDDLE BRANCH OF CROTON RIVER

near Carmel

PUTNAM CO. N.Y.







PROFILE OF COREWALL
and
SECTION THROUGH SPILLWAY CREST

PLAN OF

PROPOSED DAM

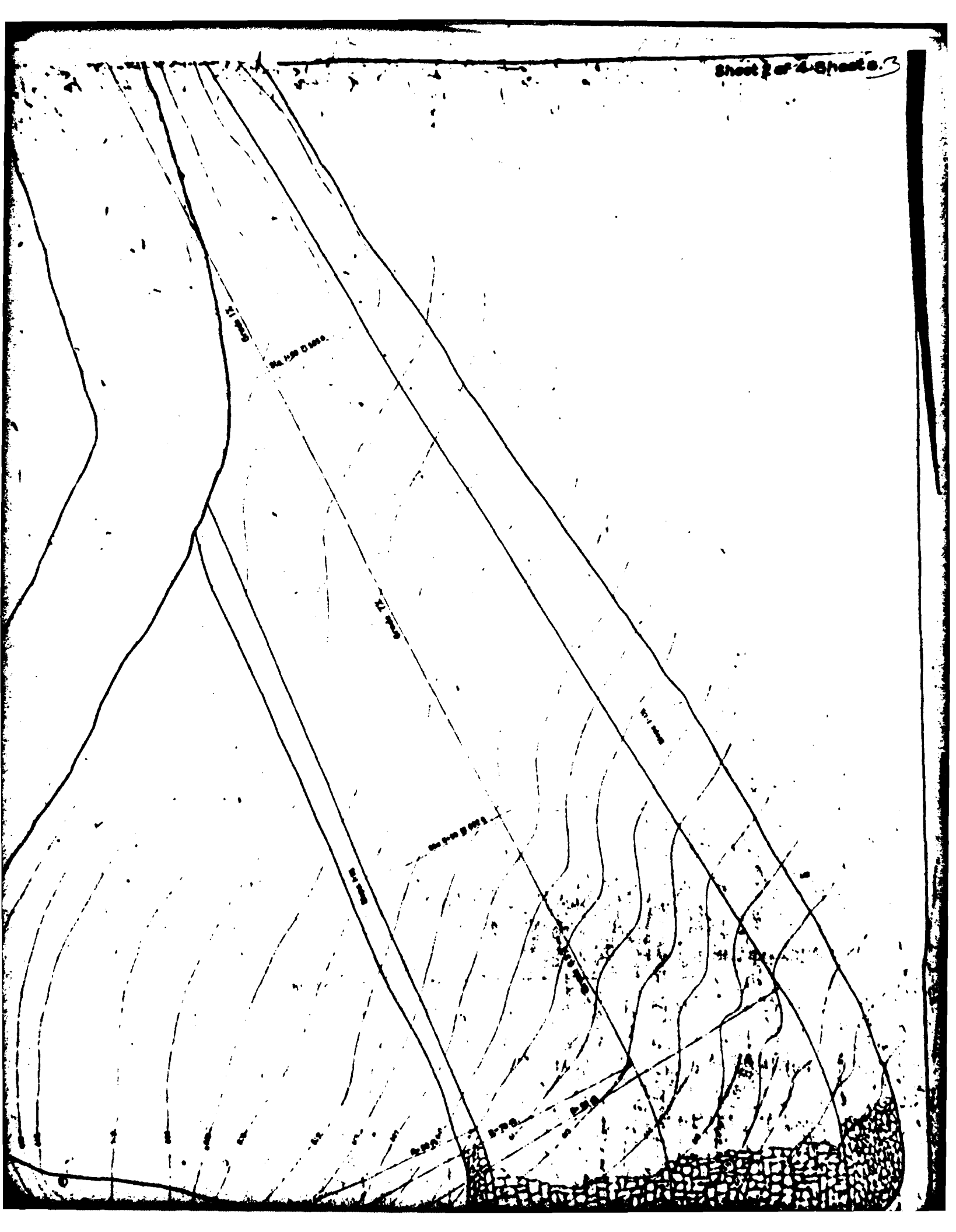
across the

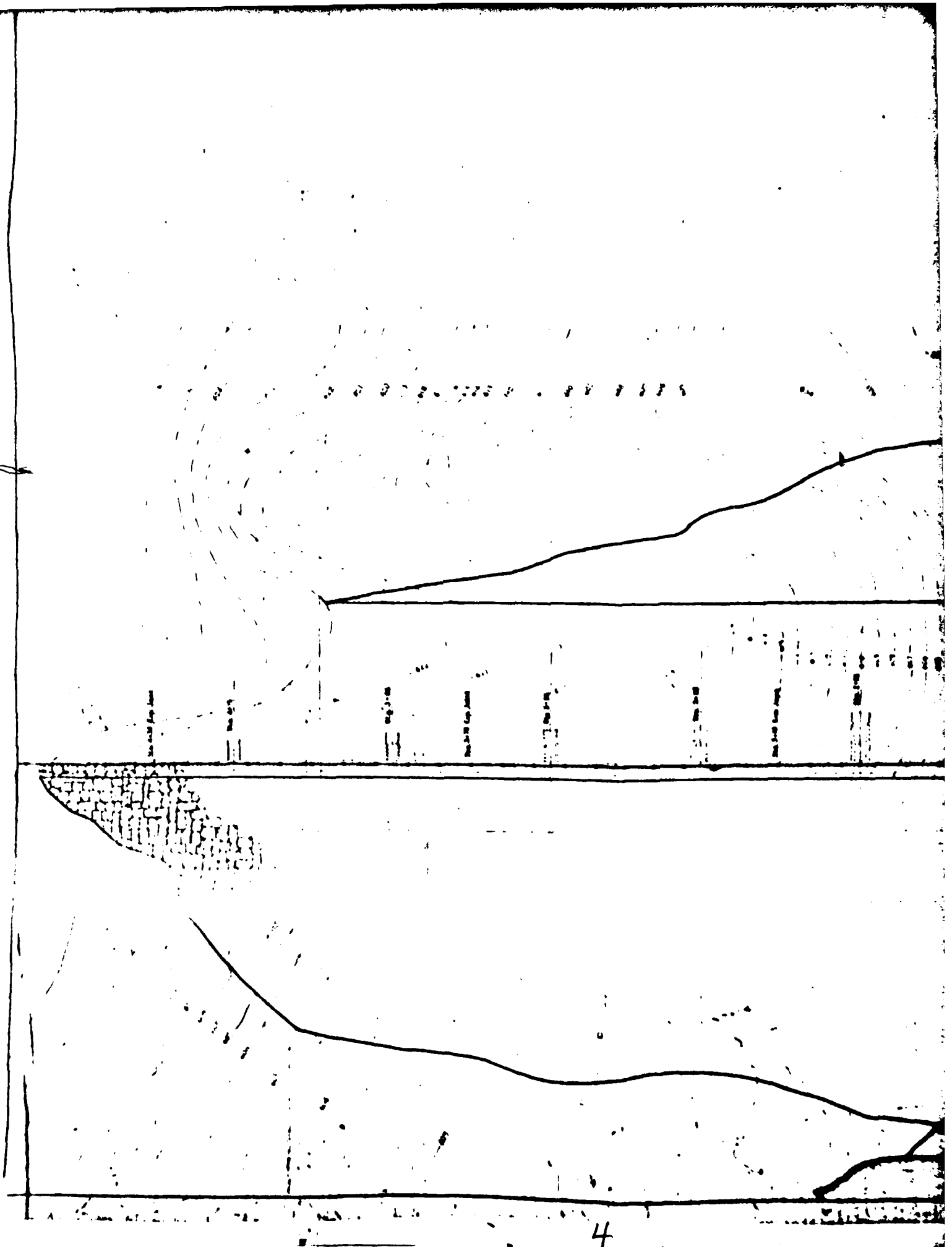
MIDDLE BRANCH OF CROTON RIVER

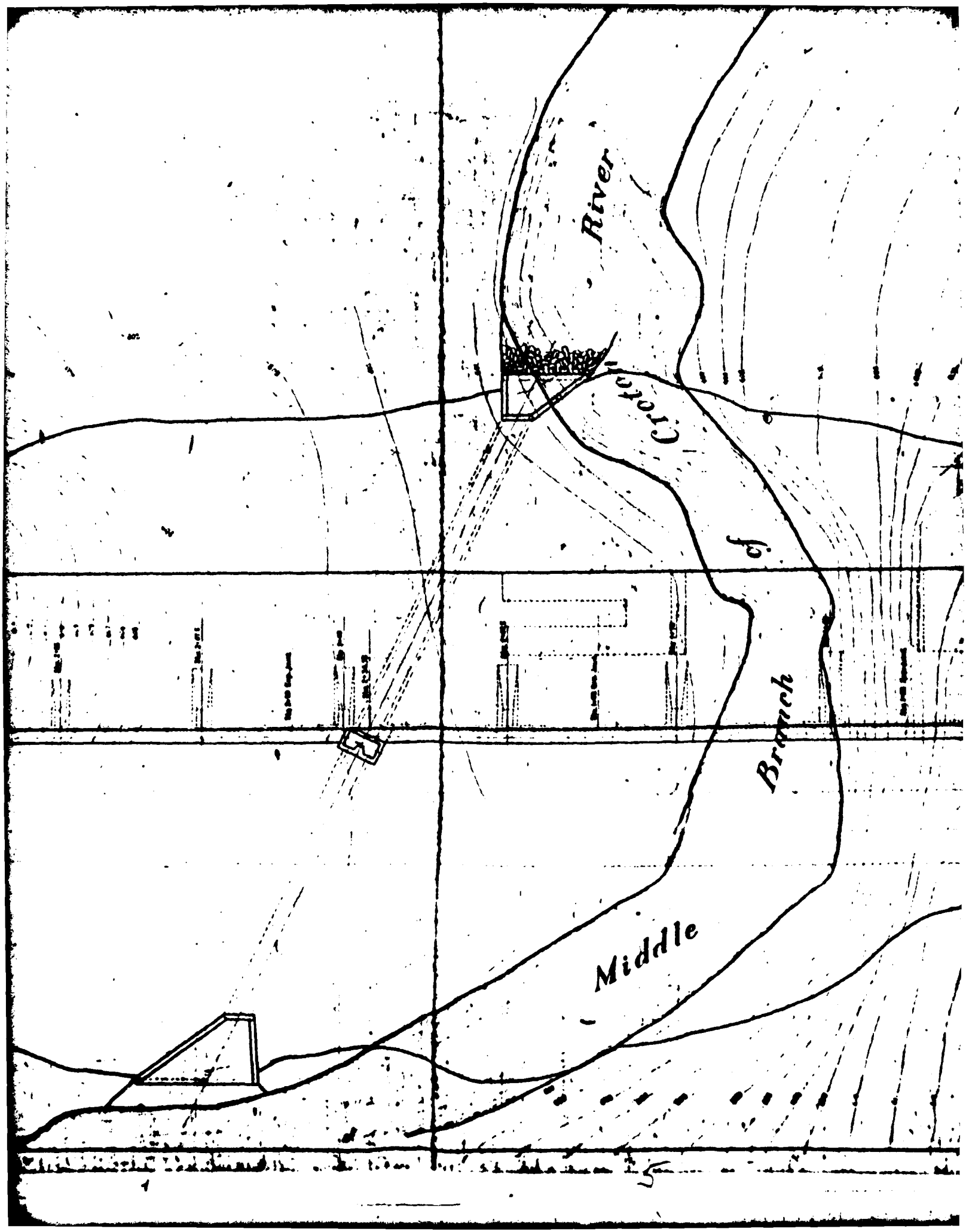
near Carmel

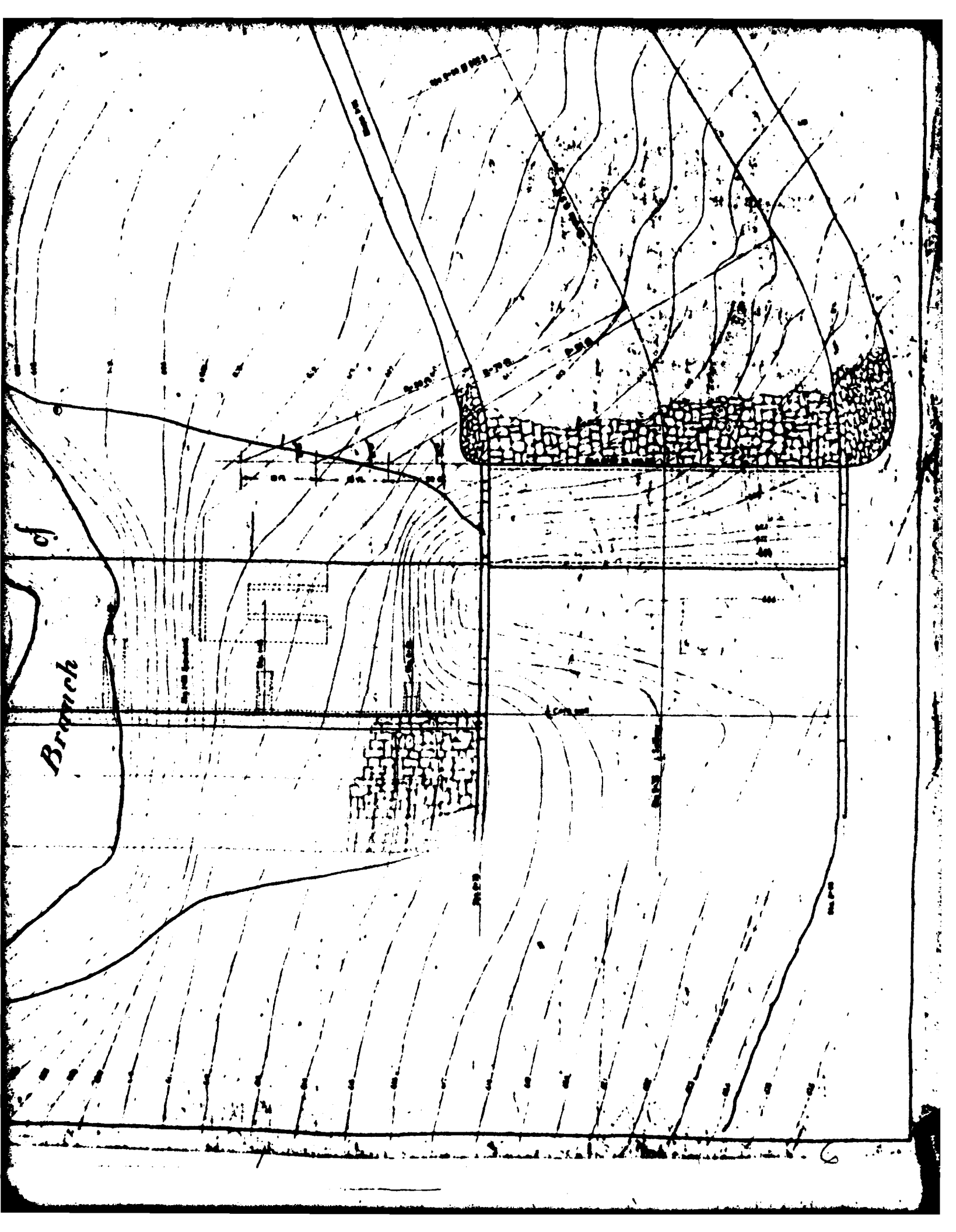
PUTNAM CO. N.Y.

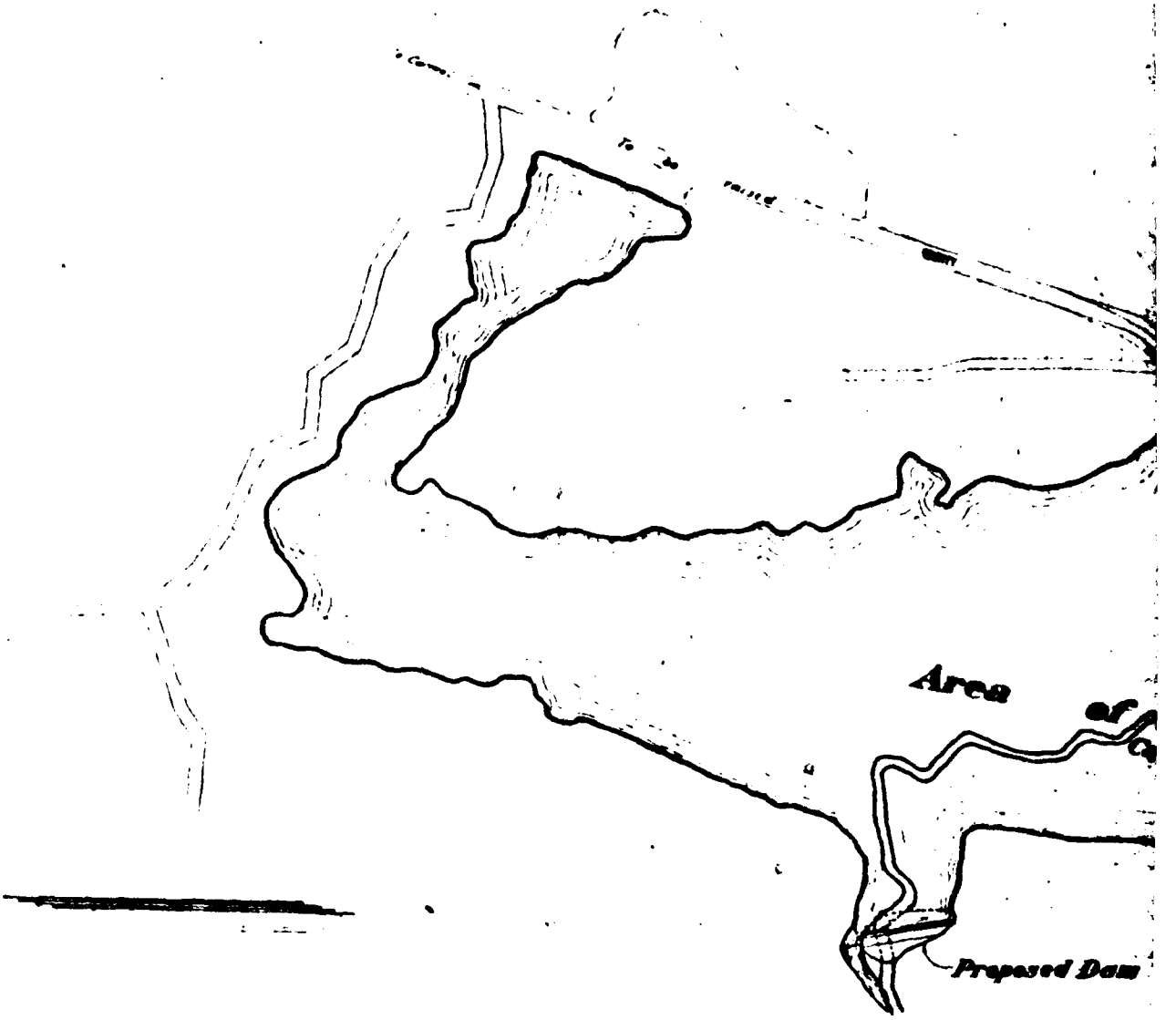

River
Croto

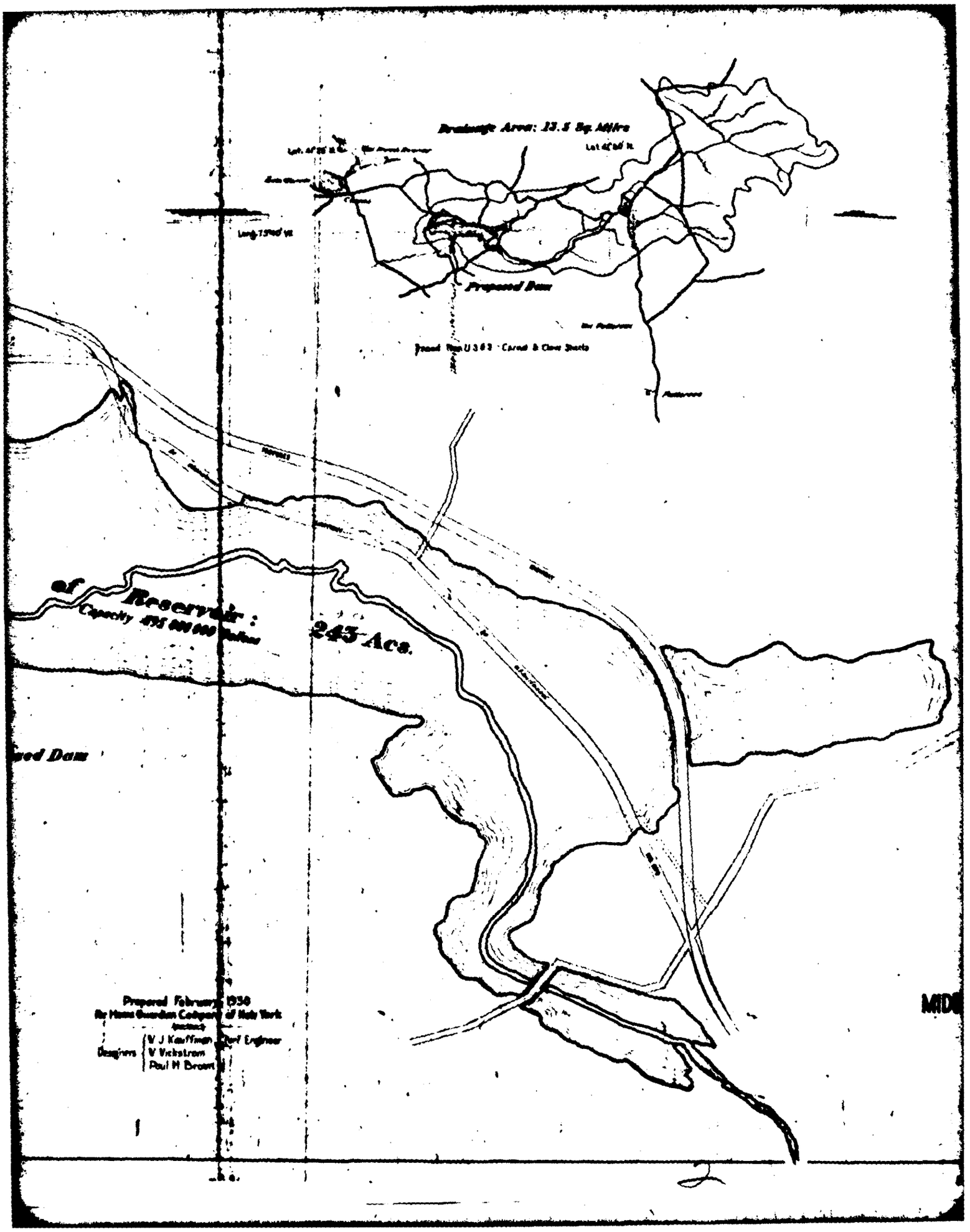


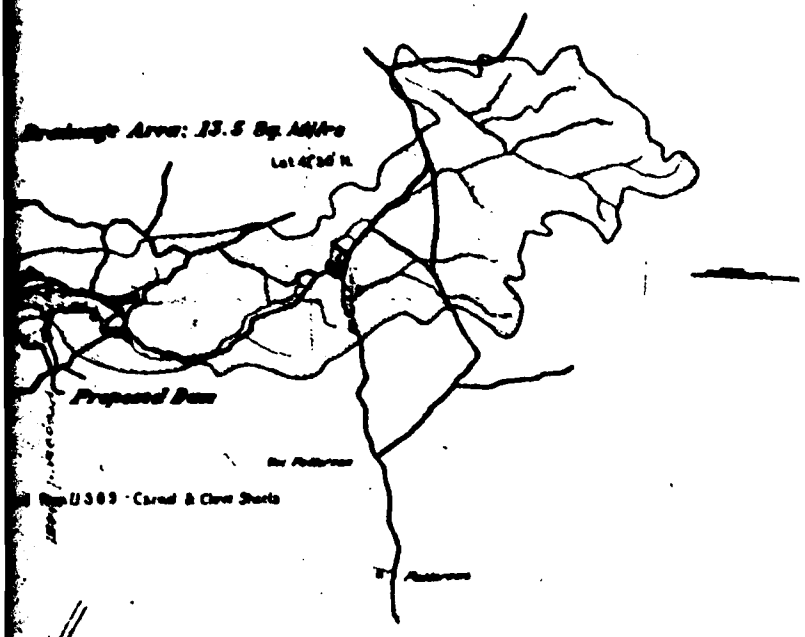


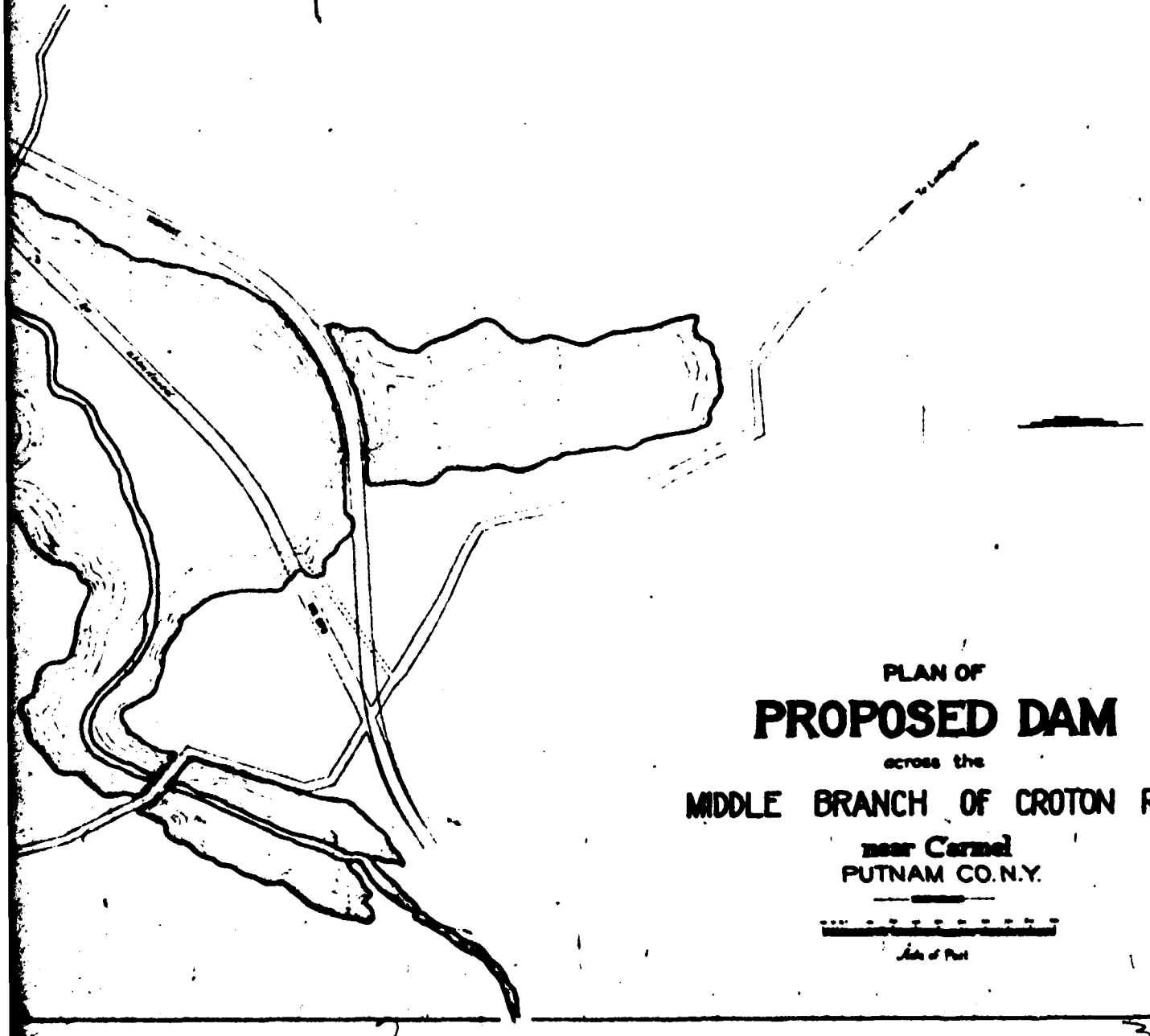

River
Croton
of
Branch
Middle


of
Branch


Area
Proposed Dam


Drainage Area: 33.5 Sq. Miles
Proposed Dam
of Reservoir:
245 Acs.
Prepared February 1950
Designers
W J Kauffman
V Vickstrom
Paul H Brown





PLAN OF

PROPOSED DAM

across the

MIDDLE BRANCH OF CROTON RIVER

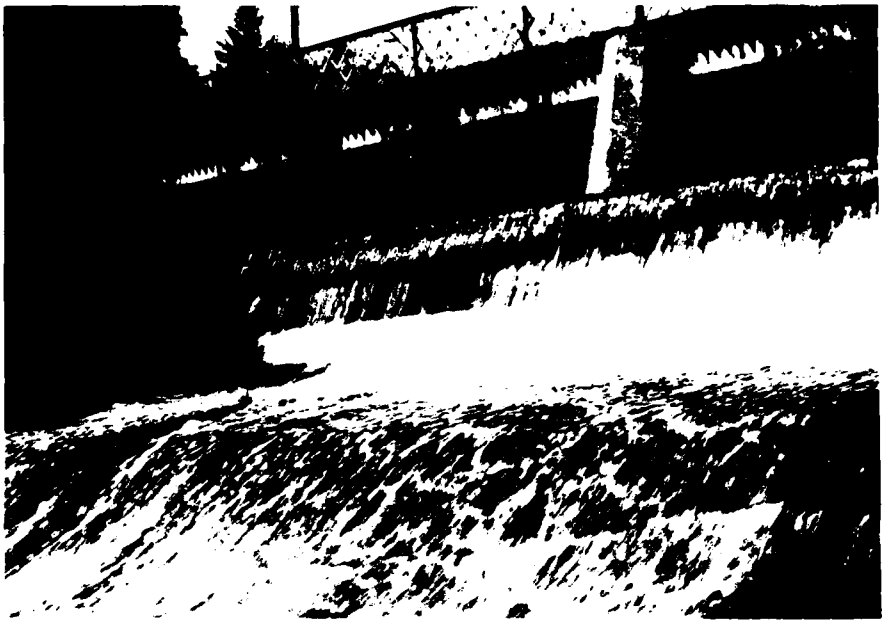
near Carmel

PUTNAM CO. N.Y.

Scale of Feet

PHOTOGRAPHS

APPENDIX B

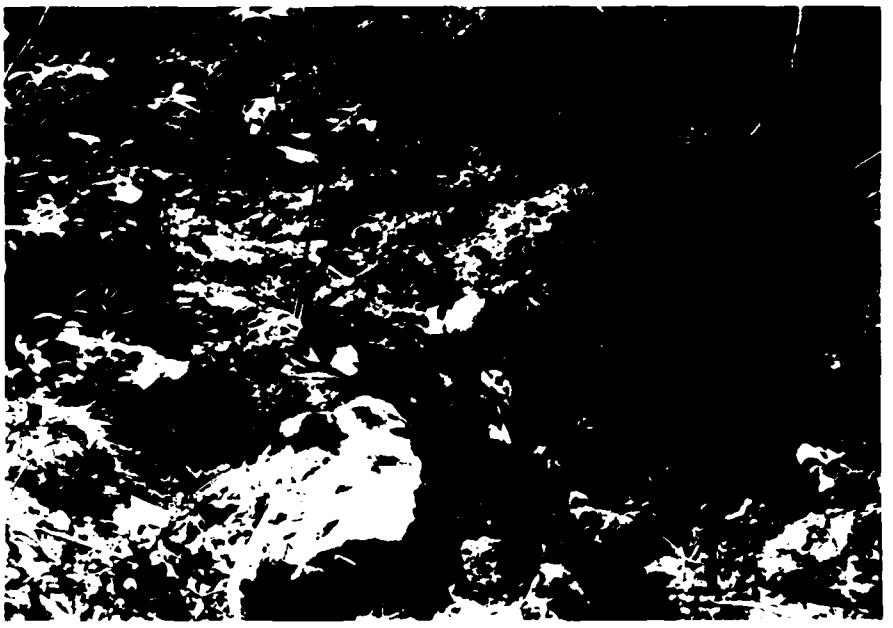


2. VIEW OF SPILLWAY CHUTE AND APRON.

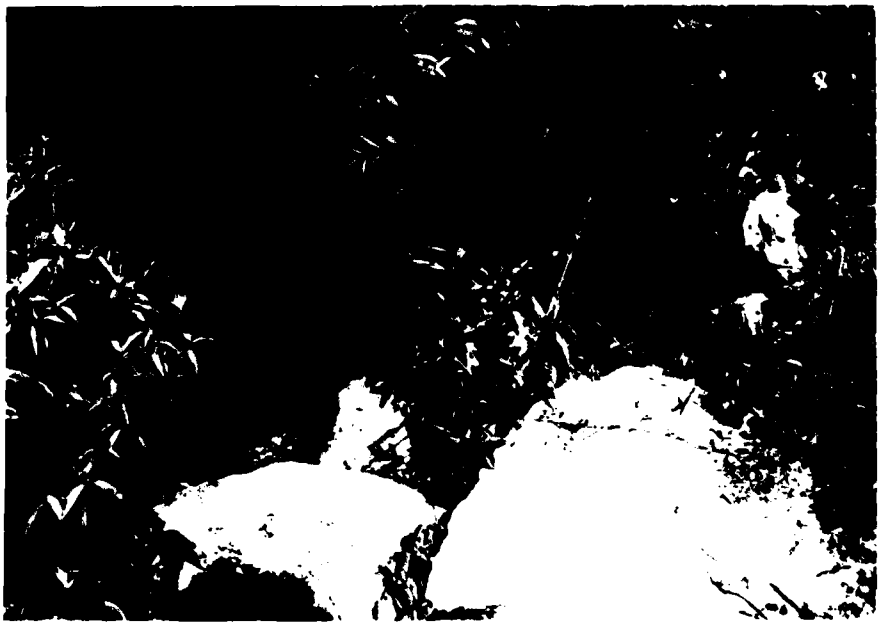
3. EROSION GULLEY ON DOWNSTREAM SLOPE.

4. EROSION GULLEY ON UPSTREAM EMBANKMENT SLOPE (NOTE: Crack in North Training Wall)

5. VIEW OF VEGETATION PRESENT ON DOWNSTREAM SLOPE.



6. LONGITUDINALLY TRANSVERSING EROSION CHANNEL LOOKING DOWNSLOPE FROM NORTH ALIGNMENT.



7. DEVELOPED RILLS ON UPSTREAM SLOPE.

8. DETERIORATING GATEHOUSE FOUNDATION. (NOTE: Absence of Riprap on Slope)

9. LOSS OF GATEHOUSE FOUNDATION ON SOUTHEAST SIDE OF STRUCTURE.

10. CRACKED WINGWALL ALONG SOUTHSIDE OF SPILLWAY APRON.

11. ERODED TOE OF SPILLWAY APRON.

VISUAL INSPECTION CHECKLIST

APPENDIX C

VISUAL INSPECTION CHECKLIST

Basic Data

a. General

Name of Dam Lake Carmel Dam

Fed. I.D. # NY 00100 DEC Dam No. 231-867

River Basin Lower Hudson

Location: Town Kent County Putnam

Stream Name Middle Branch of Croton River

Tributary of Middle Branch Reservoir

Latitude (N) 41°-27.3' Longitude (W) 073°-39.8'

Type of Dam Earth Fill

Hazard Category High (1)

Date(s) of Inspection May 26, 1981

Weather Conditions Clear & Warm 80°F

Reservoir Level at Time of Inspection El. 618.50

b. Inspection Personnel Harvey Feldman - Principal Geotechnical Engineer

John F. Wallace - Geotechnical Engineer

c. Persons Contacted (Including Address & Phone No.)

Mr. George Humphrey - Town Engineer (914)-225-9353

Route 52, Carmel, N.Y. 10512

d. History:

Date Constructed circa 1930 Date(s) Reconstructed —

Designer W. J. Kaufman, Chief Engineer; W. Wickstrom; Paul A. Brown

Constructed By Unknown

Owner Town of Kent Park District

2. Embankment

a. Characteristics

(1) Embankment Material Compacted Earth Fill

(2) Cutoff Type Reinforced Concrete Core wall Into hard clay

(3) Impervious Core Reinforced Concrete wall

(4) Internal Drainage System None

(5) Miscellaneous Upstream face partially covered by Riprap

b. Crest

(1) Vertical Alignment Good

(2) Horizontal Alignment Good

(3) Surface Cracks Crest is Asphalt paved County Road

(4) Miscellaneous -None-

c. Upstream Slope

(1) Slope (Estimate) (V:H) 1V:1.5-2.0H above EL. 618±; 1V:2.5H below EL 618±

(2) Undesirable Growth or Debris, Animal Burrows moderate growth of brush & shrubs along entire length

(3) Sloughing, Subsidence or Depressions few erosional gullies particularly along North approach wall of spillway and near gate house - appears to be associated with pedestrian access routes to lake

(4) Slope Protection Stone Riprap from ~2 feet below downstream extending below present lake level - isolated areas exist where riprap has been disturbed or is missing - appears to be result of undermining - no bedding beneath Riprap

(5) Surface Cracks or Movement at Toe None visible

d. Downstream Slope

(1) Slope (Estimate - V:H) 1V:1.5H to 1V:2.0H

(2) Undesirable Growth or Debris, Animal Burrows Heavily overgrown with deciduous trees 10-24" in diameter 30-40' ht. numerous bushes small trees and occasional debris

(3) Sloughing, Subsidence or Depressions some gullying present along pedestrian access route down slope - toe erosion near outlet structure from channelized surface runoff, minor past sloughing evidenced by bends in old trees - young trees show no evidence

(4) Surface Cracks or Movement at Toe None

(5) Seepage None

(6) External Drainage System (Ditches, Trenches; Blanket) sloping gully decining surface water traverses downstream face of slope near North abutment

(7) Condition Around Outlet Structure Appears to be good structurally some sediment build up at mouth

(8) Seepage Beyond Toe None visible

e. Abutments - Embankment Contact

good

(1) Erosion at Contact None visible

(2) Seepage Along Contact None visible

) Drainage System

a. Description of System None present

b. Condition of System N/A

c. Discharge from Drainage System N/A

) Instrumentation (Momumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.) None

6 Reservoir

a. Slopes No slides or instability observed in vicinity of Dam

b. Sedimentation Small bar appears to be building ~~across~~ entrance to spillway

c. Unusual Conditions Which Affect Dam None

5) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) several houses may be in flood plain for embankment breach

b. Seepage, Unusual Growth moderately heavy vegetation consisting of moderately large deciduous trees, bushes & shrubs

c. Evidence of Movement Beyond Toe of Dam None

d. Condition of Downstream Channel Pool immediately downstream of Low Level Outlet - Flow restricted by narrow outlet to main channel

7) Spillway(s) (Including Discharge Conveyance Channel)

Single Rectangular concrete open channel section at south abutment. 5ft deep 70ft wide w/ center span pier for support of highway bridge.

a. General Spillway channel is 50 ft in length with an upstream invert @ EL. 616.57 and downstream crest at EL. 618.12 exiting into a concrete curvilinear chute - and apron structure

b. Condition of Service Spillway Approach wall have minor cracks with both vertical & horizontal displacements of less than ¼ inch observed on north wall. South wall along the downstream chute is cracked & rotated such that a 2-3 ft separation is present at the top - Reportedly filled with injected concrete, cracking along apron bottom and wall on north side permitting water to partially undermine toe of chute on North side. Concrete on walls spalled in places

c. Condition of Auxiliary Spillway None Present

d. Condition of Discharge Conveyance Channel Partially blocked with brush and debris

Reservoir Drain/Outlet - As per original dwgs.

Type: Pipe _____ Conduit _____ Other Concrete Box

Material: Concrete X Metal _____ Other _____

Size: 4.0' x 4.0' inside dimension Length 108.0'

Invert Elevations: Entrance EL. 599.24 Exit EL. 598.24

Physical Condition (Describe): Unobservable ✓

Material: _____

Joints: _____ Alignment _____

Structural Integrity: _____

Hydraulic Capability: _____

Means of Control: Gate ✓ Valve _____ Uncontrolled _____

Operation: Operable _____ Inoperable _____ Other ✓

Present Condition (Describe): Reported by difficult to operate - Easy to open, difficulty in closing gate - stems worm gear well greased Leaks along gate sides observed while gate was closed

Structural

a. Concrete Surfaces Spillway and associated walls, chute and apron structure are generally in good condition Box culvert for Reservoir drain could not be observed except at the outlet

b. Structural Cracking Minor cracks on apron slab and in upstream downstream training walls - one major crack is present in southern downstream wall along apron

c. Movement - Horizontal & Vertical Alignment (Settlement) Minor horizontal displacement observed in trainwalls at cracks (less than ½ inch) Rotation of southern downstream wall has occurred but appears to be stable

d. Junctions with Abutments or Embankments generally good some erosion along North upstream and South downstream training walls

e. Drains - Foundation, Joint, Face None visible

f. Water Passages, Conduits, Sluices Channel section appears in good condition

g. Seepage or Leakage Leaking of overflow water to downstream toe of apron by North training wall resulting in moderate erosion and undercutting of slab corner

h. Joints - Construction, etc. Appear good Except for leakage at apron/wall joint on north side of apron

i. Foundation none visible

j. Abutments good condition

k. Control Gates none

l. Approach & Outlet Channels Sand bar in approach channel - debris and bushes present in discharge channel

m. Energy Dissipators (Plunge Pool, etc.) none

n. Intake Structures none visible

o. Stability good

p. Miscellaneous —

10) Appurtenant Structures (Powerhouse, Lock, Gatehouse, Other)

a. Description and Condition

Gatehouse - located near the east end on the upstream slope approximately midlength of the dam. Construction is primarily block over a stone wall foundation. Foundation stone are missing in places resulting in moderate distress (cracking) of the block work.

HYDROLOGIC DATA AND COMPUTATIONS

APPENDIX D

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	623.37	234	1170
2) Design High Water (Max. Design Pool)	Unknown	Unknown	Unknown
3) Auxiliary Spillway Crest	———	———	———
4) Pool Level with Flashboards	———	———	———
5) Service Spillway Crest	618.37	230Ac.	1519

DISCHARGES

	Volume (cfs)
1) Average Daily	Unknown
2) Spillway @ Maximum High Water	2830
3) Spillway @ Design High Water	unknown
4) Spillway @ Auxiliary Spillway Crest Elevation	none
5) Low Level Outlet	unknown
6) Total (of all facilities) @ Maximum High Water	2830+
7) Maximum Known Flood	Unknown
8) At Time of Inspection	200± cfs

CREST: DAM ELEVATION: 623.37

Type: Earth fill

Width: 30ft Length: 475 FT

Spillover Open channel Reinforced Concrete channel

Location Spillover SOUTH ABUTMENT

SPILLWAY:

SERVICE		AUXILIARY
618.37	Elevation	N/A
Reinforced Concrete open Channel	Type	
70 ft	Width	
	Type of Control	
Uncontrolled broad crested Concrete sill	Uncontrolled	
	Controlled:	
	Type (Flashboards; gate)	
	Number	
	Size/Length	
	Invert Material	
	Anticipated Length of operating service	
20 ft	Chute Length	
1.80 ft	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

HYDROMETEROLOGICAL GAGES:

Type : None

Location: N/A

Records:

Date - N/A

Max. Reading - N/A

FLOOD WATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (mechanisms):

Low Level gate valve (poor working condition)

DRAINAGE AREA: 13 Sq miles

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: VARIES FROM URBAN areas to wooded slopes.

Terrain - Relief: ROLLING with some steep slopes

Surface - Soil: UNKNOWN

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

None observed in the vicinity of the Dam & Reservoir

Potential Sedimentation problem areas (natural or man-made; present or future)

NONE

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

None observed.

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter: None

Location:

Elevation:

Reservoir:

Length @ Maximum Pool 0.3 (Miles)

Length of Shoreline (@ Spillway Crest) 4.9 (Miles)

TAMS

Job No. 1579-03 Sheet 1 of 25

Project LAKE CARMEL DAM Date JAN 21, 1981

Subject _____ By D.L.C.

Ch'k. by _____

LAKE EL. 619 (618.37 CREST)

LAKE PERIMETER 11.25" 22,500 / 4.26

(1.75") (3500) / 0.66

FETCH 1600'

LAKE AREA

.0890
.0687
.0484
2.03
2.03
2.03 in²
2.185 200.64 ac

above Kent Corner

.1260
3 1- 0.155 in²

.1229

DRAINAGE AREA

(Lake Carmel Quad)

.7934
.4657
.1374
32.77
32.83
32.80 in²

(Poughquag Quad)

.1341
.0164
.0188
57.7
57.6
57.75 in²

10.55 in² 8314.47 ac

12.99 sq m.

620' Contour

.3096
.2842
.2587
2.54
2.55
2.545 233.7 ac

TAMS

Job No. _____ Sheet 2 of 25

Project LAKE CARMEL DAM Date JAN 22, 1981

Subject _____ By D.L.C.

_____ Ch'k. by _____

630' Contour

3786

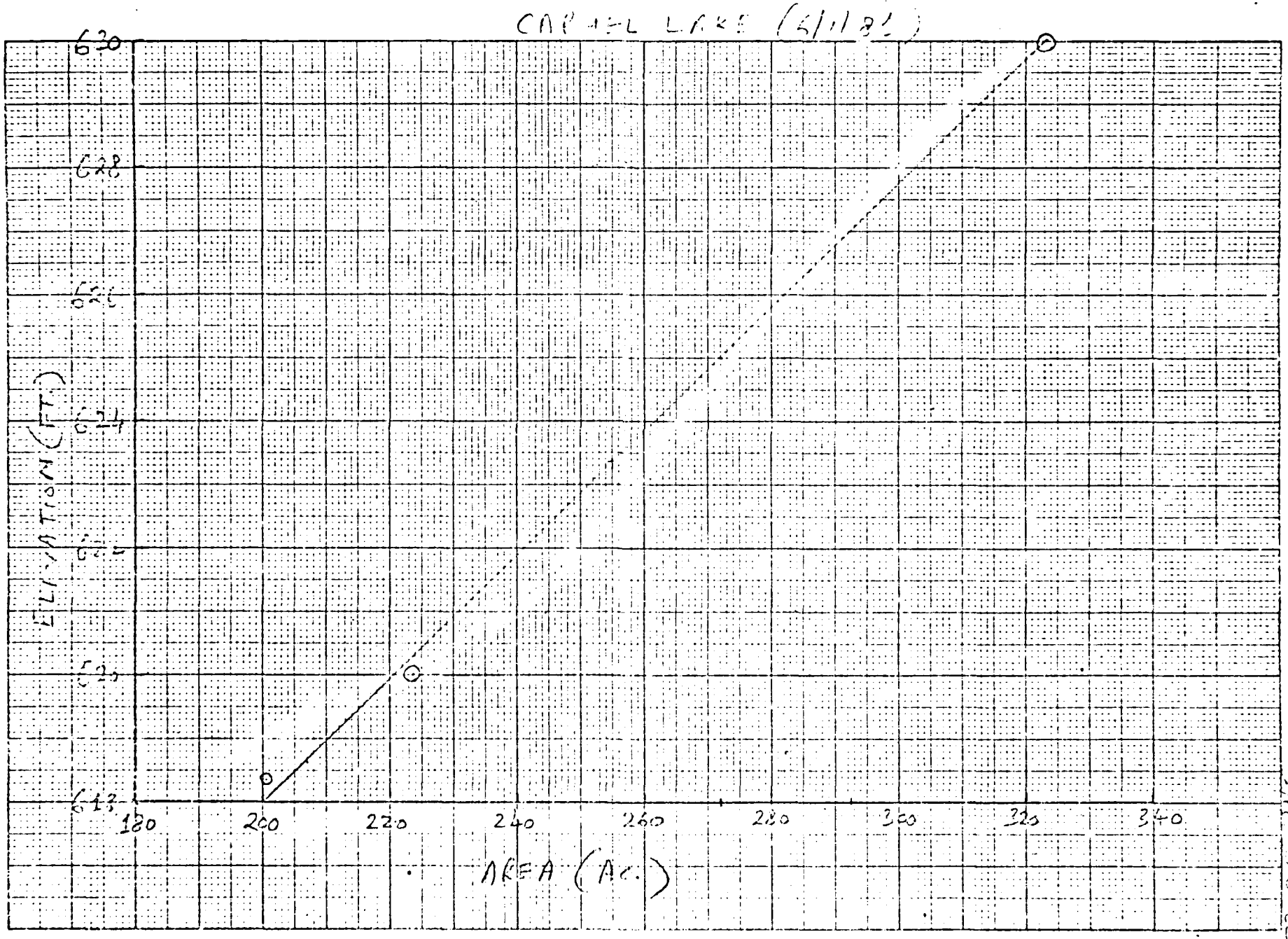
3435 3.51 / 3.53 / 3.52 in² 323.23 ac

3082

Developed Area adjacent to Lake

4976

3791 11.65 − 2.19 = 9.46 in² = 887.0 acres or 1.4 sq miles.


CAMEL LAKE (6/11/81)
630
628
626
624
622
ELEVATION (FT.)
180
200
220
240
260
280
300
320
340
AREA (AC.)

TAMS

Job No. 1579-03 Sheet 24 of 25
Project LAKE CARMEL DAM INSP. Date June 1 1981
Subject HYDRAULIC / HYDROLOGIC COMPUTATIONS By D.K. [illegible]
Ch'k. by

ELEVATION VS SURCHARGE STORAGE

EL	ΔH	AREA (AC.)	MEAN AREA (AC.)	ΔVOL (AC.FT.)	SURCHARGE VOLUME
618.37	0	200.64	-		0
620	1.63	233.7	217.17	354	354
623.37	3.37	250.5	242.1	816	1170
625	1.63	270.2	260.35	424	1594
627	2	290.25	280.23	560.	2155
630	3	323.23	306.74	920	3075

% Impervious = LAKE AREA / BASIN AREA = $\frac{210.64}{8314.97}$ = 0.024.

SPILLWAY DISCHARGES

Let us assume the spillway as a broad Crested Weir. From the crest level 618.37 ft to the top of opening at (618.37 + 3.5) 621.87 ft. the formula $Q = CLH^{3/2}$ is used with C = 2.63.

$$L = 70 - 1.5$$

$$= 68.5 \text{ ft.}$$

TAMS

Job No. 1579-03 Sheet 25 of 25
Project LAKE CARMEL DAM INSP. Date June 2, 1981
Subject HYDRAULIC/HYDROLOGIC COMPUTATION By D. K. BOEHM
Ch'k. by

FLOW AT LEVEL 620 ft.

$$H = (620 - 618.37) = 1.63 \text{ ft}$$

$$Q = 2.63 \times 68.5 \times (1.63)^{1.5} \text{ cfs}$$

$$= \boxed{375 \text{ cfs}}$$

FLOW AT LEVEL 621.87 ft. (TOP OF OPENING)

$$H = (621.87 - 618.37) = 3.5 \text{ ft}$$

$$Q = 2.63 \times 68.5 \times (3.5)^{1.5} \text{ cfs}$$

$$= \boxed{1,180 \text{ cfs.}}$$

ABOVE LEVEL 621.87, FLOW IS CONSIDERED TO BE ORIFICE FLOW USING FORMULA

$$Q = c\,a\sqrt{2gh}$$

where c is computed from $Q = a\sqrt{\frac{2gh}{K}}$, $K = 1.5$

$$c = \sqrt{\frac{1}{K}} = 0.816$$

FLOW AT LEVEL 623.37 (TOP OF DAM/BRIDGE)

$$h = 623.37 - \left(618.37 + \frac{3.5}{2}\right)$$
$$= 3.25 \text{ ft.}$$

$$Q = 0.816 \times 68.5 \times 3.5\sqrt{2 \times 32.2 \times 3.25}$$

$$= \boxed{2,830 \text{ cfs.}}$$

FLOW AT LEVEL 625 ft

$$h = 625 - (618.37 + \tfrac{3.5}{2})$$

$$= 4.88 \text{ ft}$$

$$Q = 0.816 \times 3.5 \times 68.5 \times \sqrt{2 \times 32.2 \times 4.88} \text{ cfs.}$$

$$= \boxed{3,468} \text{ cfs.}$$

FLOW AT LEVEL 630 ft

$$h = 630 - (618.37 + \tfrac{3.5}{2})$$

$$= 9.88$$

$$Q = 0.816 \times 3.5 \times 68.5 \times \sqrt{2 \times 32.2 \times 9.88} \text{ cfs.}$$

$$= \boxed{4,935} \text{ cfs}$$

WEIR FLOW OVER THE BRIDGE FROM EL. 623.37 FT.

⇒ WILL BE COMPUTED BY USING HEC-1DB.

TAMS

Job No. 1579-03 Sheet 4 of 25
Project LAKE CARMEL DAM INSP. Date June 2, 1991
Subject HYDROLOGIC COMPUTATIONS By D. K. Boka
Ch'k. by

$L = 21'' = 42{,}000$ ft $= 7.95$ miles.

$L_{CA} = 10.4'' = 20{,}300$ ft $= 3.94$ miles.

Use $C_p = 0.625$ | $640\,C_p = 400$

$C_T = 2.0$

$$T_p = 2.0\,(7.95 \times 3.94)^{0.3} \text{ hours}$$

$$= 5.62 \text{ hours.}$$

Use $t_R = 1$ hr.

$$\therefore t_{PR} = 5.62 + 0.25\left(1.0 - \frac{5.62}{5.5}\right)$$

$$= 5.61$$

TAMS

Job No. 1579-03 Sheet 5 of 25

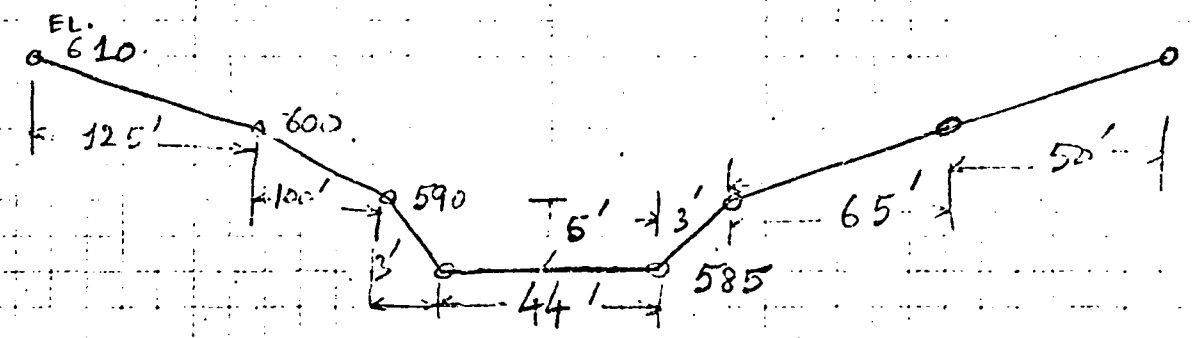
Project LAKE CARMEL DAM INCR. Date June 3, 1981

Subject HYDRAULIC COMPUTATIONS ON THE D/S CHANNEL By D. K. BOHAN

Ch'k. by

$$\text{Length} = \frac{7}{8} \times 2000 = 1750 \text{ ft.}$$

$$\text{Slope} = 10/(3.5/8 \times 2000) = 0.0114$$



CO-ORDINATES OF THE EIGHT POINTS:

(0,610) (125,600) (225,590) (228,585)

(272,585) (275,590) (340,600) (390,610)

```
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  01 APR 80
*********************************
            A1                          LAKE CARMEL DAM
            A2                        PHASE 1 INSPECTION
            A3                     HEC-1DB PMF ANALYSIS  JUNE 81
            B   100      1       0       0       0       0       0       0       0       0
            B1    5
            J     1      4       1
            J1    1   0.75     0.5    0.25
            K     0      1                                       1
            K1       1 BASIN INFLOW HYDROGRAPH
            M     1      1      13              13                               1
            P           22     112     123     133     141
            T                                                    1     0.1           0.024
            W  5.61  0.625
            X    -1   -0.1     1.5
            K     1      2                                       1
            K1       2 ROUTE THROUGH LAKE
            Y                                1       1
            Y1    1                                           1620      -1
            Y4618.37   620  621.87  623.37     625     630
            Y5    0    375    1180    2830    3468    4935
            SS 1620   1974    2790    3214    3775    4695
            SE618.37   620  623.37     625     627     630
            $S618.37
            $D623.37  3.09     1.5     475
            K     1      3                                       1
            K1       3 CHANNEL ROUTING D/S OF DAM
            Y                                1       1
            Y1    1
            Y6 0.035  0.035  0.035     585     610    1750  0.0114
            Y7    0    610     125     600     225     590     228     585     272     585
            Y7  275    590     340     600     390     610
            K    99
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Sheet 9 of 25

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PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

        RUNOFF HYDROGRAPH AT          1
        ROUTE HYDROGRAPH TO           2
        ROUTE HYDROGRAPH TO           3
        END OF NETWORK
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
RUNOFF HYDROGRAPH AT          1
ROUTE HYDROGRAPH TO           2
ROUTE HYDROGRAPH TO           3
END OF NETWORK
```



```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********

RUN  DATE= 81/07/21.
     TIME= 12.35.58.
```

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********

RUN  DATE= 81/07/21.
     TIME= 12.35.58.
```

LAKE CARMEL DAM
PHASE 1 INSPECTION
HEC-1DB PMF ANALYSIS JUNE 81

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	1	0	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 4 LRTIO= 1

RTIOS= 1.00 .75 .50 .25

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

1 BASIN INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	13.00	0.00	13.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.00	112.00	123.00	133.00	141.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .809

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.10	0.00	.02

UNIT HYDROGRAPH DATA
TP= 5.64 CP= .62 NTA= 0

RECESSION DATA
STRTQ= -1.00 QRCSN= -.10 RTIOR= 1.50

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 6.40 AND R= 5.24 INTERVALS

UNIT HYDROGRAPH 32 END-OF-PERIOD ORDINATES, LAG= 5.60 HOURS, CP= .62 VOL= 1.00

64.	233.	460.	693.	866.	936.	879.	742.	612.	506.	
417.	345.	285.	235.	194.	160.	132.	109.	90.	74.	

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61.	51.	42.	35.	29.	24.	19.	16.	13.	11.	
9.	7.									

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	1.00	1	.01	.00	.01	12.	1.03	3.00	51	0.00	0.00	0.00	7021.
1.01	2.00	2	.01	.00	.01	12.	1.03	4.00	52	0.00	0.00	0.00	5849.
1.01	3.00	3	.01	.00	.01	12.	1.03	5.00	53	0.00	0.00	0.00	4857.
1.01	4.00	4	.01	.00	.01	11.	1.03	6.00	54	0.00	0.00	0.00	4030.

61. 51. 42. 35. 29. 24. 19. 16. 13. 11.
9. 7.

Q MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	1.00	1	.01	.00	.01	12.	1.03	3.00	51	0.00	0.00	0.00	7021.
1.01	2.00	2	.01	.00	.01	12.	1.03	4.00	52	0.00	0.00	0.00	5949.
1.01	3.00	3	.01	.00	.01	12.	1.03	5.00	53	0.00	0.00	0.00	4857.
1.01	4.00	4	.01	.00	.01	11.	1.03	6.00	54	0.00	0.00	0.00	4020.
1.01	5.00	5	.01	.00	.01	11.	1.03	7.00	55	0.00	0.00	0.00	3321.
1.01	6.00	6	.01	.00	.01	11.	1.03	8.00	56	0.00	0.00	0.00	2742.
1.01	7.00	7	.02	.00	.02	11.	1.03	9.00	57	0.00	0.00	0.00	2264.
1.01	8.00	8	.02	.00	.02	10.	1.03	10.00	58	0.00	0.00	0.00	1870.
1.01	9.00	9	.02	.00	.02	10.	1.03	11.00	59	0.00	0.00	0.00	1646.
1.01	10.00	10	.02	.00	.02	10.	1.03	12.00	60	0.00	0.00	0.00	1590.
1.01	11.00	11	.02	.00	.02	10.	1.03	13.00	61	0.00	0.00	0.00	1517.
1.01	12.00	12	.02	.00	.02	10.	1.03	14.00	62	0.00	0.00	0.00	1457.
1.01	13.00	13	.12	.00	.12	10.	1.03	15.00	63	0.00	0.00	0.00	1399.
1.01	14.00	14	.14	.00	.14	11.	1.03	16.00	64	0.00	0.00	0.00	1344.
1.01	15.00	15	.18	.00	.18	12.	1.03	17.00	65	0.00	0.00	0.00	1290.
1.01	16.00	16	.46	.06	.40	17.	1.03	18.00	66	0.00	0.00	0.00	1239.
1.01	17.00	17	.17	.07	.10	33.	1.03	19.00	67	0.00	0.00	0.00	1190.
1.01	18.00	18	.13	.03	.10	61.	1.03	20.00	68	0.00	0.00	0.00	1143.
1.01	19.00	19	.01	.00	.01	97.	1.03	21.00	69	0.00	0.00	0.00	1097.
1.01	20.00	20	.01	.00	.01	130.	1.03	22.00	70	0.00	0.00	0.00	1054.
1.01	21.00	21	.01	.00	.01	152.	1.03	23.00	71	0.00	0.00	0.00	1012.
1.01	22.00	22	.01	.00	.01	159.	1.04	0.00	72	0.00	0.00	0.00	971.
1.01	23.00	23	.01	.00	.01	148.	1.04	1.00	73	0.00	0.00	0.00	933.
1.02	0.00	24	.01	.00	.01	128.	1.04	2.00	74	0.00	0.00	0.00	896.
1.02	1.00	25	.12	.02	.10	108.	1.04	3.00	75	0.00	0.00	0.00	860.
1.02	2.00	26	.12	.02	.10	96.	1.04	4.00	76	0.00	0.00	0.00	826.
1.02	3.00	27	.12	.02	.10	91.	1.04	5.00	77	0.00	0.00	0.00	793.
1.02	4.00	28	.12	.02	.10	93.	1.04	6.00	78	0.00	0.00	0.00	762.
1.02	5.00	29	.12	.02	.10	101.	1.04	7.00	79	0.00	0.00	0.00	731.
1.02	6.00	30	.12	.02	.10	112.	1.04	8.00	80	0.00	0.00	0.00	702.
1.02	7.00	31	.33	.23	.10	137.	1.04	9.00	81	0.00	0.00	0.00	674.
1.02	8.00	32	.33	.23	.10	195.	1.04	10.00	82	0.00	0.00	0.00	648.
1.02	9.00	33	.33	.23	.10	299.	1.04	11.00	83	0.00	0.00	0.00	622.
1.02	10.00	34	.33	.23	.10	449.	1.04	12.00	84	0.00	0.00	0.00	597.
1.02	11.00	35	.33	.23	.10	634.	1.04	13.00	85	0.00	0.00	0.00	573.
1.02	12.00	36	.33	.23	.10	803.	1.04	14.00	86	0.00	0.00	0.00	551.
1.02	13.00	37	1.99	1.90	.10	1126.	1.04	15.00	87	0.00	0.00	0.00	529.
1.02	14.00	38	2.39	2.29	.10	1697.	1.04	16.00	88	0.00	0.00	0.00	508.
1.02	15.00	39	2.99	2.89	.10	2725.	1.04	17.00	89	0.00	0.00	0.00	488.
1.02	16.00	40	7.56	7.46	.10	4603.	1.04	18.00	90	0.00	0.00	0.00	468.
1.02	17.00	41	2.79	2.69	.10	7450.	1.04	19.00	91	0.00	0.00	0.00	450.
1.02	18.00	42	2.19	2.10	.10	10800.	1.04	20.00	92	0.00	0.00	0.00	432.
1.02	19.00	43	.18	.08	.10	13923.	1.04	21.00	93	0.00	0.00	0.00	415.
1.02	20.00	44	.18	.08	.10	16027.	1.04	22.00	94	0.00	0.00	0.00	398.
1.02	21.00	45	.18	.08	.10	16718.	1.04	23.00	95	0.00	0.00	0.00	382.
1.02	22.00	46	.18	.08	.10	15918.	1.05	0.00	96	0.00	0.00	0.00	367.
1.02	23.00	47	.18	.08	.10	14103.	1.05	1.00	97	0.00	0.00	0.00	353.
1.03	0.00	48	.18	.08	.10	12018.	1.05	2.00	98	0.00	0.00	0.00	339.
1.03	1.00	49	0.00	0.00	0.00	10068.	1.05	3.00	99	0.00	0.00	0.00	325.
1.03	2.00	50	0.00	0.00	0.00	8411.	1.05	4.00	100	0.00	0.00	0.00	312.
									SUM	25.10	21.51	3.59	205640.
										(637.)	(546.)	(91.)	(5823.08)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	16718.	14683.	7126.	2834.	205478.
CMS	473.	416.	202.	80.	5818.
INCHES		10.51	20.40	24.34	24.51
MM		266.97	518.09	618.12	622.44
AC-FT		7291.	14135.	16864.	16992.
THOUS CU M		8981.	17435.	20801.	20947.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	16718.	14683.	7126.	2834.	205478.
CMS	473.	416.	202.	80.	5818.
INCHES		10.51	20.40	24.34	24.51
MM		266.87	518.09	618.12	622.44
AC-FT		7281.	14135.	16864.	16982.
THOUS CU M		8981.	17435.	20801.	20947.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

12.	12.	12.	11.	11.	11.	11.	10.	10.	10.
10.	10.	10.	11.	12.	17.	33.	61.	97.	130.
152.	159.	143.	128.	108.	96.	91.	93.	101.	112.
137.	195.	299.	449.	634.	833.	1126.	1697.	2725.	4603.
7450.	10800.	13923.	16027.	16716.	15918.	14103.	12018.	10068.	8411.
7021.	5849.	4857.	4020.	3321.	2742.	2264.	1870.	1646.	1560.
1517.	1457.	1399.	1344.	1290.	1239.	1190.	1143.	1097.	1054.
1012.	971.	933.	896.	860.	826.	793.	762.	731.	702.
674.	648.	622.	597.	573.	551.	529.	508.	488.	468.
450.	432.	415.	398.	382.	367.	353.	339.	325.	312.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	16718.	14683.	7126.	2834.	205478.
CMS	473.	416.	202.	80.	5818.
INCHES		10.51	20.40	24.34	24.51
MM		266.87	518.09	618.12	622.44
AC-FT		7281.	14135.	16864.	16982.
THOUS CU M		8981.	17435.	20801.	20947.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

9.	9.	9.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	9.	15.	25.	46.	72.	97.
114.	119.	111.	96.	81.	72.	69.	70.	76.	84.
103.	146.	224.	337.	476.	625.	844.	1273.	2044.	3452.
5588.	8100.	10442.	12020.	12538.	11939.	10577.	9013.	7551.	6308.
5266.	4387.	3643.	3015.	2491.	2057.	1698.	1402.	1234.	1185.
1136.	1093.	1044.	1008.	968.	929.	892.	857.	823.	790.
759.	729.	700.	672.	645.	620.	595.	571.	549.	527.
506.	486.	466.	448.	430.	413.	397.	381.	366.	351.
337.	324.	311.	299.	287.	275.	264.	254.	244.	234.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12538.	11012.	5345.	2126.	154109.
CMS	355.	312.	151.	60.	4364.
INCHES		7.88	15.30	18.25	18.38
MM		200.15	388.56	463.59	466.83
AC-FT		5461.	10601.	12648.	12736.
THOUS CU M		6736.	13076.	15601.	15710.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 3

6.	6.	6.	6.	6.	5.	5.	5.	5.	5.
5.	5.	5.	5.	6.	9.	17.	31.	48.	65.
76.	79.	74.	64.	54.	48.	45.	46.	50.	56.
68.	97.	149.	225.	317.	417.	563.	849.	1363.	2302.
3725.	5400.	6961.	8013.	8359.	7959.	7052.	6009.	5034.	4205.

Sheet 13 of 25

3511.	2924.	2429.	2010.	1661.	1371.	1132.	935.	823.	790.
759.	729.	700.	672.	645.	620.	595.	571.	549.	527.
506.	486.	466.	448.	430.	413.	397.	381.	366.	351.
337.	324.	311.	299.	287.	275.	264.	254.	244.	234.
225.	216.	207.	199.	191.	184.	176.	169.	163.	156.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8359.	7341.	3563.	1417.	102739.
CMS	237.	208.	101.	40.	2909.

3511.	2924.	2429.	2010.	1661.	1371.	1132.	935.	823.	790.
759.	729.	700.	672.	645.	620.	595.	571.	549.	527.
506.	486.	466.	448.	430.	413.	397.	381.	366.	351.
337.	324.	311.	299.	287.	275.	264.	254.	244.	234.
225.	216.	207.	199.	191.	184.	176.	169.	163.	156.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8359.	7341.	3563.	1417.	102739.
CMS	237.	208.	101.	40.	2909.
INCHES		5.25	10.20	12.17	12.25
MM		133.43	259.04	309.06	311.22
AC-FT		3640.	7067.	8432.	8491.
THOUS CU M		4490.	8717.	10401.	10473.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 4

3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	4.	8.	15.	24.	32.
38.	40.	37.	32.	27.	24.	23.	23.	25.	28.
34.	49.	75.	112.	159.	208.	281.	424.	681.	1151.
1863.	2700.	3481.	4007.	4179.	3980.	3526.	3004.	2517.	2103.
1755.	1462.	1214.	1005.	830.	686.	566.	467.	411.	395.
379.	364.	350.	336.	323.	310.	297.	286.	274.	263.
253.	242.	233.	224.	215.	207.	198.	190.	183.	176.
169.	162.	155.	149.	143.	138.	132.	127.	122.	117.
112.	108.	104.	100.	96.	92.	88.	85.	81.	78.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4179.	3671.	1782.	709.	51369.
CMS	118.	104.	50.	20.	1455.
INCHES		2.63	5.10	6.08	6.13
MM		66.72	129.52	154.53	155.61
AC-FT		1820.	3534.	4216.	4245.
THOUS CU M		2245.	4359.	5200.	5237.

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HYDROGRAPH ROUTING

2 ROUTE THROUGH LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	1620.	-1

STAGE	618.37	620.00	621.87	623.37	625.00	630.00
FLOW	0.00	375.00	1180.00	2830.00	3468.00	4935.00
CAPACITY=		1620.	1974.	2790.	3214.	3775.	4695.

Sheet 14 of 25

ELEVATION=	618.	620.	623.	625.	627.	630.

CREL	SPWID	COOW	EXPW	FLEVL	COOL	CAREA	EXPL
618.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COAD	EXPD	DAMWID
[illegible]	[illegible]	1.5	4[illegible]

ELEVATION= 618. 620. 623. 625. 627. 630.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
618.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
623.4	3.1	1.5	475.

STATION 2, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

1.	2.	3.	4.	4.	5.	5.	6.	6.	6.
7.	7.	8.	8.	8.	10.	13.	19.	26.	
36.	46.	55.	62.	67.	70.	72.	73.	75.	78.
82.	89.	102.	125.	160.	208.	273.	368.	616.	1033.
2423.	5498.	10131.	13816.	15783.	16198.	15280.	13567.	11619.	9859.
8349.	7072.	5954.	5002.	4233.	3612.	3125.	2800.	2471.	2199.
1994.	1834.	1706.	1600.	1511.	1433.	1364.	1301.	1244.	1191.
1163.	1140.	1114.	1087.	1058.	1029.	999.	968.	938.	908.
878.	848.	819.	790.	762.	735.	708.	682.	657.	632.
609.	586.	563.	542.	521.	501.	482.	463.	445.	429.

STORAGE

1621.	1622.	1623.	1623.	1624.	1624.	1625.	1625.	1626.	1626.
1626.	1627.	1627.	1627.	1627.	1628.	1629.	1632.	1639.	1645.
1654.	1664.	1672.	1679.	1683.	1686.	1688.	1689.	1691.	1694.
1697.	1704.	1716.	1738.	1771.	1816.	1877.	1968.	2110.	2344.
2700.	3127.	3502.	3750.	3880.	3908.	3847.	3755.	3667.	3583.
3508.	3263.	3167.	3091.	3002.	2929.	2857.	2787.	2721.	2651.
2606.	2571.	2542.	2519.	2500.	2482.	2467.	2453.	2441.	2429.
2417.	2404.	2390.	2374.	2358.	2342.	2325.	2308.	2291.	2274.
2257.	2240.	2224.	2208.	2192.	2176.	2161.	2147.	2133.	2119.
2105.	2092.	2080.	2068.	2056.	2045.	2034.	2024.	2013.	2004.

STAGE

618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4
618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.5	618.5
618.5	618.6	618.6	618.6	618.7	618.7	618.7	618.7	618.7	618.7
618.7	618.8	618.8	618.9	619.1	619.3	619.6	620.0	620.6	621.5
623.0	624.7	626.0	626.9	627.3	627.4	627.2	626.9	626.4	626.0
625.5	625.2	624.8	624.5	624.2	623.9	623.6	623.3	623.0	622.8
622.6	622.5	622.3	622.2	622.2	622.1	622.0	622.0	621.9	621.9
621.8	621.8	621.7	621.7	621.6	621.5	621.4	621.4	621.3	621.2
621.2	621.1	621.0	621.0	620.9	620.8	620.8	620.7	620.7	620.6
620.5	620.5	620.4	620.4	620.3	620.3	620.2	620.2	620.2	620.1

PEAK OUTFLOW IS 16198. AT TIME 46.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	16198.	14253.	6910.	2781.	200845.
CMS	459.	404.	196.	79.	5687.
INCHES		10.20	19.78	23.88	23.95
MM		259.06	502.56	606.60	608.41
AC-FT		7068.	13706.	16550.	16569.
THOUS CU M		8718.	16906.	20414.	20475.

STATION 2, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

STATION 2, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

1.	1.	2.	3.	3.	4.	4.	4.	5.	5.
5.	5.	5.	6.	6.	6.	7.	10.	14.	20.
27.	35.	41.	47.	50.	52.	54.	55.	57.	58.
61.	67.	77.	94.	120.	156.	205.	276.	403.	724.
1327.	3049.	6527.	9709.	11605.	12086.	11458.	10225.	8837.	7538.
6403.	5391.	4561.	3887.	3343.	2934.	2629.	2389.	1981.	1737.
1555.	1416.	1307.	1219.	1165.	1126.	1105.	1073.	1041.	1009.
977.	945.	914.	892.	852.	822.	792.	764.	736.	709.
682.	657.	632.	608.	585.	563.	541.	520.	500.	481.
462.	444.	427.	410.	394.	378.	368.	359.	350.	340.

STORAGE

1621.	1621.	1622.	1623.	1623.	1623.	1624.	1624.	1624.	1625.
1625.	1625.	1625.	1625.	1626.	1626.	1627.	1628.	1633.	1639.
1646.	1653.	1659.	1664.	1667.	1669.	1671.	1672.	1673.	1675.
1679.	1[illegible]	1[illegible]	1708.	1733.	1767.	1813.	1891.	1990.	2070.
2459.	2644.	3014.	3472.	3606.	3638.	3596.	3509.	3406.	3302.
3204.	3116.	3037.	2963.	2892.	2820.	2746.	2671.	2605.	2549.
2509.	2479.	2455.	2435.	2419.	2402.	2385.	2367.	2349.	2331.
2313.	2295.	2277.	2259.	2242.	2225.	2209.	2193.	2177.	2162.
2147.	2133.	2119.	2105.	2092.	2080.	2067.	2056.	2044.	2033.
2023.	2013.	2003.	1994.	1985.	1976.	1967.	1959.	1950.	1941.

STAGE

618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4
618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.5
618.5	618.5	618.5	618.6	618.6	618.6	618.6	618.6	618.6	618.6
618.6	618.7	618.7	618.8	618.9	619.0	619.3	619.6	620.1	620.8
622.0	623.6	625.0	625.9	626.4	626.5	626.4	626.1	625.7	625.3
625.0	624.6	624.3	624.0	623.8	623.5	623.2	622.9	622.6	622.4
622.2	622.1	622.0	621.9	621.8	621.8	621.7	621.6	621.5	621.5
621.4	621.3	621.3	621.2	621.1	621.0	621.0	620.9	620.8	620.8
620.7	620.7	620.6	620.5	620.5	620.4	620.4	620.3	620.3	620.2
620.2	620.2	620.1	620.1	620.0	620.0	620.0	619.9	619.9	619.8

PEAK OUTFLOW IS 12086. AT TIME 44.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12086.	10473.	5122.	2080.	150230.
CMS	342.	297.	145.	59.	4254.
INCHES		7.49	14.60	17.86	17.92
MM		190.34	372.36	453.72	455.08
AC-FT		5193.	10159.	12379.	12416.
THOUS CU M		6405.	12531.	15269.	15315.

STATION 2, PLAN 1, RATIO 3

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

1.	1.	1.	2.	2.	2.	3.	3.	3.	3.
3.	3.	4.	4.	4.	4.	5.	7.	9.	13.
18.	23.	28.	31.	33.	35.	36.	37.	38.	39.
41.	44.	51.	62.	80.	104.	136.	184.	261.	405.
762.	1415.	2696.	5170.	7110.	7602.	7604.	6903.	6003.	5128.
4382.	3762.	3258.	2886.	2578.	2242.	1929.	1646.	1403.	1215.
1135.	1041.	1031.	964.	939.	897.	858.	820.	784.	751.
719.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

OUTFLOW

1.	1.	1.	2.	2.	2.	3.	3.	3.	3.
3.	3.	4.	4.	4.	4.	5.	7.	9.	13.
18.	23.	28.	31.	33.	35.	36.	37.	38.	39.
41.	44.	51.	62.	80.	104.	136.	184.	261.	405.
762.	1415.	2896.	5170.	7110.	7802.	7604.	6903.	6003.	5128.
4342.	3762.	3258.	2886.	2578.	2242.	1929.	1646.	1403.	1215.
1135.	1061.	1031.	984.	939.	897.	858.	820.	784.	751.
719.	688.	659.	631.	605.	580.	556.	533.	511.	490.
470.	451.	433.	415.	399.	382.	370.	361.	351.	342.
333.	323.	314.	305.	295.	286.	277.	269.	260.	252.

STORAGE

1620.	1621.	1621.	1622.	1622.	1622.	1622.	1623.	1623.	1623.
1623.	1623.	1623.	1624.	1624.	1624.	1625.	1626.	1629.	1632.
1637.	1642.	1646.	1649.	1652.	1653.	1654.	1655.	1656.	1657.
1659.	1662.	1668.	1679.	1695.	1718.	1749.	1794.	1867.	1991.
2192.	2479.	2811.	3097.	3266.	3324.	3308.	3248.	3171.	3093.
3019.	2948.	2879.	2809.	2734.	2661.	2592.	2529.	2476.	2434.
2401.	2371.	2343.	2316.	2291.	2268.	2245.	2224.	2204.	2185.
2167.	2150.	2134.	2118.	2103.	2089.	2076.	2063.	2051.	2039.
2028.	2017.	2007.	1997.	1987.	1978.	1969.	1961.	1952.	1943.
1934.	1925.	1916.	1907.	1899.	1890.	1882.	1874.	1865.	1857.

STAGE

618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4
618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4
618.4	618.5	618.5	618.5	618.5	618.5	618.5	618.5	618.5	618.5
618.5	618.6	618.6	618.6	618.7	618.8	619.0	619.2	619.5	620.1
620.9	622.1	623.5	624.5	625.2	625.4	625.3	625.1	624.8	624.5
624.2	624.0	623.7	623.4	623.1	622.8	622.6	622.3	622.1	621.9
621.8	621.6	621.5	621.4	621.3	621.2	621.1	621.0	621.0	620.9
620.8	620.7	620.7	620.6	620.5	620.5	620.4	620.4	620.3	620.3
620.2	620.2	620.1	620.1	620.1	620.0	620.0	619.9	619.9	619.9
619.8	619.8	619.7	619.7	619.7	619.6	619.6	619.5	619.5	619.5

PEAK OUTFLOW IS 7802. AT TIME 46.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7802.	6762.	3351.	1383.	99872.
CMS	221.	191.	95.	39.	2828.
INCHES		4.84	9.59	11.88	11.91
MM		122.90	243.59	301.63	302.53
AC-FT		3353.	6646.	8229.	8254.
THOUS CU M		4136.	8197.	10151.	10181.

STATION 2, PLAN 1, RATIO 4

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	1.	1.	1.	1.	1.	1.	2.	2.
2.	2.	2.	2.	2.	2.	2.	3.	5.	7.
9.	12.	14.	16.	17.	17.	18.	18.	19.	19.
20.	22.	26.	31.	40.	52.	68.	92.	131.	197.
306.	533.	883.	1399.	2251.	2829.	3108.	3170.	3016.	2818.
2537.	2244.	1957.	1689.	1445.	1228.	1118.	1036.	954.	879.

Sheet 17 of 25

812.	751.	697.	649.	605.	556.	530.	497.	467.	440.
415.	392.	373.	361.	349.	337.	326.	315.	304.	294.
284.	274.	264.	255.	246.	237.	228.	220.	212.	204.
197.	189.	182.	176.	169.	163.	157.	151.	145.	140.

STORAGE

1620.	1620.	1621.	1621.	1621.	1621.	1621.	1621.	1621.	1622.
1622.	1622.	1622.	1622.	1622.	1622.	1622.	1623.	1624.	1626.
1629.	1631.	1633.	1635.	1636.	1635.	1635.	1637.	1638.	1638.

812.	751.	697.	649.	605.	566.	530.	497.	467.	440.
415.	392.	373.	361.	349.	337.	326.	315.	304.	294.
284.	274.	264.	255.	246.	237.	228.	220.	212.	204.
197.	189.	182.	176.	169.	163.	157.	151.	145.	140.

STORAGE

1620.	1620.	1621.	1621.	1621.	1621.	1621.	1621.	1621.	1622.
1622.	1622.	1622.	1622.	1622.	1622.	1622.	1623.	1624.	1626.
1629.	1631.	1633.	1635.	1636.	1636.	1637.	1637.	1638.	1638.
1639.	1641.	1644.	1649.	1659.	1669.	1684.	1707.	1743.	1806.
1909.	2063.	2260.	2475.	2662.	2790.	2855.	2865.	2837.	2787.
2725.	2661.	2598.	2539.	2485.	2437.	2392.	2346.	2300.	2257.
2220.	2186.	2155.	2128.	2103.	2091.	2061.	2043.	2026.	2011.
1997.	1984.	1972.	1960.	1949.	1938.	1928.	1917.	1907.	1897.
1888.	1878.	1869.	1860.	1852.	1843.	1835.	1828.	1820.	1813.
1806.	1799.	1792.	1786.	1780.	1774.	1768.	1762.	1757.	1752.

STAGE

618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4
618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4
618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.4	618.5	618.5
618.5	618.5	618.5	618.5	618.5	618.6	618.7	618.8	618.9	619.2
619.7	620.4	621.2	622.1	622.8	623.4	623.6	623.7	623.6	623.4
623.1	622.8	622.6	622.3	622.1	621.9	621.7	621.5	621.3	621.2
621.0	620.9	620.7	620.6	620.5	620.4	620.4	620.3	620.2	620.2
620.1	620.0	620.0	619.9	619.9	619.8	619.8	619.7	619.7	619.6
619.6	619.6	619.5	619.5	619.4	619.4	619.4	619.3	619.3	619.3
619.2	619.2	619.2	619.1	619.1	619.1	619.1	619.0	619.0	619.0

PEAK OUTFLOW IS 3170. AT TIME 48.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3170.	2889.	1609.	689.	49779.
CMS	90.	82.	46.	20.	1410.
INCHES		2.07	4.61	5.92	5.94
MM		52.51	117.01	150.34	150.79
AC-FT		1433.	3192.	4102.	4114.
THOUS CU M		1767.	3938.	5059.	5075.

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HYDROGRAPH ROUTING

3 CHANNEL ROUTING D/S OF DAM

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	1	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	ICPT	IPRR	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

Sheet 18 of 35

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0350	.0350	.0350	585.0	610.0	1750.	.01140

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0350	.0350	.0350	585.0	610.0	1750.	.01140

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 610.00 125.00 600.00 225.00 590.00 228.00 585.00 272.00 585.00
275.00 590.00 340.00 600.00 390.00 610.00

STORAGE	0.00	2.37	4.82	7.35	9.99	13.44	18.03	23.77	30.66	38.70
	47.89	58.22	69.71	82.41	96.34	111.47	127.83	145.40	164.19	184.20
OUTFLOW	0.00	311.16	975.20	1895.87	3036.14	4601.07	6608.76	9189.65	12437.74	16438.16
	21270.12	27008.43	33693.11	41423.25	50293.10	60370.18	71720.64	84409.20	98499.15	114052.43
STAGE	585.00	586.32	587.63	588.95	590.26	591.58	592.89	594.21	595.53	596.84
	598.16	599.47	600.79	602.11	603.42	604.74	606.05	607.37	608.68	610.00
FLOW	0.00	311.16	975.20	1895.87	3036.14	4601.07	6608.76	9189.65	12437.74	16438.16
	21270.12	27008.43	33693.11	41423.25	50293.10	60370.18	71720.64	84409.20	98499.15	114052.43

STATION 3, PLAN 1, RTIO 1

OUTFLOW

2.	1.	3.	3.	4.	5.	5.	6.	6.	6.
7.	7.	7.	8.	8.	8.	10.	13.	18.	26.
35.	45.	54.	61.	66.	69.	72.	73.	75.	78.
51.	88.	101.	122.	156.	203.	266.	362.	601.	1013.
2356.	5395.	9957.	13770.	15733.	16224.	15307.	13629.	11655.	9912.
8377.	7112.	5976.	5032.	4246.	3637.	3131.	2811.	2478.	2207.
1998.	1839.	1709.	1634.	1513.	1436.	1365.	1304.	1245.	1193.
1163.	1141.	1116.	1088.	1059.	1030.	999.	970.	939.	909.
879.	849.	820.	792.	763.	736.	709.	683.	658.	633.
610.	587.	564.	543.	522.	502.	453.	464.	446.	429.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	2.	2.	3.	3.	5.
8.	15.	25.	33.	37.	38.	36.	33.	29.	25.
22.	12.	17.	14.	13.	11.	10.	9.	9.	8.
8.	7.	7.	7.	6.	6.	6.	6.	6.	5.
5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
3.	3.	3.	3.	3.	3.	3.	3.	3.	3.

STAGE

585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0
585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.1	585.1	585.1
585.1	585.2	585.2	585.3	585.3	585.3	585.3	585.3	585.3	585.3
585.3	585.4	585.4	585.5	585.7	585.9	586.1	586.4	586.9	587.7
589.5	592.1	594.5	596.0	596.6	596.8	596.5	595.9	595.2	594.5
593.8	593.2	592.5	591.7	591.3	590.8	590.3	590.0	589.6	589.3
589.1	588.9	588.7	588.5	588.4	588.3	588.2	588.1	588.0	587.9

Sheet 17 of 25

587.9	587.9	587.8	587.8	587.8	587.7	587.7	587.6	587.6	587.5
587.6	587.4	587.3	587.3	587.2	587.2	587.1	587.1	587.0	587.0
586.9	586.9	586.8	586.8	586.7	586.7	586.7	586.6	586.6	586.5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	16224.	14246.	6909.	2781.	200614.
CMS	459.	403.	196.	79.	5686.
INCHES		10.19	19.78	23.88	23.95
MM		[illegible]	502.30	606.52	608.31
AC-FT		[illegible]	[illegible]	[illegible]	[illegible]

587.9	587.9	587.8	587.8	587.8	587.7	587.7	587.6	587.6	587.5
587.4	587.4	587.3	587.3	587.2	587.2	587.1	587.1	587.0	587.0
586.9	586.9	586.8	586.8	586.7	586.7	586.7	586.6	586.6	586.5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	16224.	14246.	6929.	2791.	200814.
CMS	459.	403.	196.	79.	5686.
INCHES		10.19	19.78	23.88	23.95
MM		258.93	502.30	606.52	608.31
AC-FT		7064.	13704.	16547.	16596.
THOUS CU M		8713.	16904.	20411.	20471.

MAXIMUM STORAGE = 38.

MAXIMUM STAGE IS 596.2

STATION 30 PLAN 1 RTIO 2

OUTFLOW

1.	1.	2.	2.	3.	3.	4.	4.	5.	5.
5.	5.	5.	6.	6.	6.	7.	9.	13.	19.
26.	34.	41.	46.	50.	52.	54.	55.	56.	58.
61.	65.	75.	92.	117.	152.	200.	268.	395.	704.
1[illegible].	2976.	6642.	9655.	11566.	12099.	11478.	10268.	8867.	7577.
6[illegible].	5[illegible].	4574.	3910.	3351.	2948.	2632.	2303.	1984.	1749.
1[illegible].	1[illegible].	1307.	1225.	1164.	1139.	1104.	1076.	1041.	1012.
97[illegible].	9[illegible].	914.	885.	852.	824.	793.	765.	737.	710.
6[illegible].	6[illegible].	638.	609.	586.	564.	542.	521.	501.	482.
462.	444.	427.	411.	395.	379.	368.	359.	350.	341.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	1.	1.	1.	1.	2.	2.	3.	4.
6.	10.	16.	25.	29.	30.	29.	26.	23.	20.
16.	15.	13.	12.	11.	10.	9.	8.	8.	7.
6.	6.	6.	6.	5.	5.	5.	5.	5.	5.
5.	5.	5.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	2.

STAGE

585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0
585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.1	585.1
585.1	585.1	585.2	585.2	585.2	585.2	585.2	585.2	585.2	585.2
585.2	[illegible]	[illegible]	585.4	585.5	585.6	585.8	586.1	586.5	587.1
588.1	590.[illegible]	592.8	594.4	595.2	595.4	595.1	594.6	594.0	593.4
592.8	592.1	591.6	591.0	590.5	590.1	589.8	589.4	589.0	588.7
588.5	588.3	588.1	588.0	587.9	587.9	587.8	587.8	587.7	587.7
587.6	587.6	587.5	587.5	587.4	587.3	587.3	587.2	587.2	587.1
587.1	587.0	587.0	586.9	586.9	586.8	586.8	586.7	586.7	586.7
586.6	586.6	586.5	586.5	586.5	586.5	586.4	586.4	586.4	586.4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12099.	10482.	5122.	2060.	150200.
CMS	343.	297.	145.	59.	4253.

Sheet 20 of 25

INCHES	2.50	14.66	17.86	17.91
MM	190.51	372.38	453.65	454.99
AC-FT	5198.	10159.	12377.	12413.
THOUS CU M	6411.	12531.	15266.	15311.

MAXIMUM STORAGE = 30.

INCHES	7.50	14.66	17.86	17.91
MM	190.51	372.38	453.65	454.99
AC-FT	5198.	10159.	12377.	12413.
THOUS CU M	6411.	12531.	15266.	15311.

MAXIMUM STORAGE = 30.

MAXIMUM STAGE IS 595.4

STATION 3, PLAN 1, RTIO 3

OUTFLOW

1.	1.	2.	2.	2.	2.	3.	3.	3.	3.
3.	3.	4.	4.	4.	4.	5.	6.	9.	13.
19.	23.	27.	31.	33.	35.	36.	37.	38.	39.
41.	44.	50.	61.	78.	102.	133.	179.	253.	395.
741.	1368.	2838.	5105.	7067.	7805.	7611.	6932.	6023.	5150.
4397.	3781.	3266.	2897.	2584.	2254.	1934.	1659.	1408.	1223.
1133.	1086.	1030.	988.	939.	901.	858.	823.	789.	753.
719.	690.	660.	633.	606.	581.	557.	534.	512.	491.
471.	452.	434.	416.	399.	383.	371.	361.	356.	342.
333.	324.	314.	305.	296.	287.	278.	269.	261.	252.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	1.	1.	2.	3.
4.	6.	9.	15.	19.	21.	20.	19.	17.	15.
13.	12.	10.	10.	9.	8.	7.	7.	6.	6.
5.	5.	5.	5.	5.	5.	4.	4.	4.	4.
4.	4.	4.	4.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	3.	3.	3.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.

STAGE

585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0
585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.1
585.1	585.1	585.1	585.1	585.1	585.1	585.2	585.2	585.2	585.2
585.2	585.2	585.2	585.3	585.3	585.4	585.6	585.8	586.1	586.5
587.2	588.2	590.0	591.9	593.1	593.5	593.4	593.1	592.5	591.9
591.4	590.9	590.4	590.1	589.7	589.4	589.0	588.6	588.2	588.0
587.9	587.8	587.7	587.6	587.6	587.5	587.4	587.3	587.3	587.2
587.1	587.1	587.0	587.0	586.9	586.9	586.8	586.8	586.7	586.7
586.6	586.6	586.6	586.5	586.5	586.5	586.4	586.4	586.4	586.4
586.4	586.3	586.3	586.3	586.3	586.2	586.2	586.1	586.1	586.1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7805.	6721.	3350.	1383.	99849.
CMS	221.	191.	95.	39.	2827.
INCHES		4.84	9.59	11.87	11.91
MM		122.89	243.56	301.57	302.46
AC-FT		3333.	6645.	8228.	8252.
THOUS CU M		4136.	8196.	10149.	10179.

MAXIMUM STORAGE = 21.

MAXIMUM STAGE IS 593.5

STATION 3, PLAN 1, RTIO 4

OUTFLOW

0.	0.	1.	1.	1.	1.	1.	1.	2.	2.

MAXIMUM STORAGE = 21.

MAXIMUM STAGE IS 593.5

STATION 3, PLAN 1, RTIO 4

OUTFLOW

0.	0.	1.	1.	1.	1.	1.	1.	2.	2.
2.	2.	2.	2.	2.	2.	3.	4.	6.	
9.	11.	14.	15.	17.	17.	18.	18.	19.	19.
20.	22.	25.	31.	39.	51.	67.	89.	126.	189.
294.	513.	863.	1382.	2216.	2830.	3093.	3181.	3014.	2830.
2541.	2255.	1962.	1702.	1450.	1238.	1117.	1043.	954.	585.
812.	756.	698.	653.	606.	568.	550.	499.	468.	442.
416.	394.	373.	351.	349.	338.	326.	315.	305.	295.
284.	274.	265.	255.	246.	238.	229.	221.	213.	205.
197.	190.	183.	176.	170.	163.	157.	151.	146.	140.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	1.	1.
2.	3.	4.	6.	8.	9.	10.	10.	10.	9.
9.	8.	8.	7.	6.	6.	5.	5.	5.	4.
4.	4.	4.	4.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	1.	1.	1.	1.	1.	1.	1.	1.	1.

STAGE

585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0
585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0	585.0
585.0	585.0	585.1	585.1	585.1	585.1	585.1	585.1	585.1	585.1
585.1	585.1	585.1	585.1	585.2	585.2	585.3	585.4	585.5	585.8
586.2	586.7	587.4	588.2	589.3	590.0	590.3	590.4	590.2	590.0
587.7	589.4	589.0	588.7	588.3	588.0	587.8	587.7	587.6	587.5
587.3	587.2	587.1	587.0	586.9	586.8	586.8	586.7	586.6	586.6
586.5	586.5	586.4	586.4	586.4	586.4	586.3	586.3	586.3	586.2
586.2	586.2	586.1	586.1	586.0	586.0	586.0	585.9	585.9	585.9
585.8	585.8	585.8	585.7	585.7	585.7	585.7	585.6	585.6	585.6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3161.	2888.	1609.	689.	49767.
CMS	90.	82.	46.	20.	1409.
INCHES		2.07	4.61	5.92	5.94
MM		52.48	117.00	150.31	150.75
AC-FT		1432.	3192.	4101.	4113.
THOUS CU M		1766.	3937.	5058.	5073.

MAXIMUM STORAGE = 10.

MAXIMUM STAGE IS 590.4

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .75	RATIO 3 .50	RATIO 4 .25
HYDROGRAPH AT	1	13.00 (33.67)	1	16718. (473.39)	12538. (355.04)	8359. (236.69)	4179. (118.35)
ROUTED TO	2	13.00 (33.67)	1	16198. (458.68)	12086. (342.25)	7802. (220.93)	3170. (89.75)
ROUTED TO	3	13.00 (33.67)	1	16224. (459.41)	12099. (342.60)	7805. (221.02)	3181. (90.06)

Sheet 24 of 25

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	613.37	618.37	623.37
	STORAGE	1620.	1620.	2790.
	OUTFLOW	0.	0.	2830.

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	618.37	618.37	623.37
STORAGE	1620.	1620.	2790.
OUTFLOW	0.	0.	2830.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	627.43	4.06	3908.	16198.	16.00	46.00	0.00
.75	626.51	3.14	3638.	12086.	15.00	46.00	0.00
.50	625.39	2.02	3324.	7802.	12.00	46.00	0.00
.25	623.66	.29	2865.	3170.	3.00	48.00	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	16224.	596.8	46.00
.75	12099.	595.4	46.00
.50	7805.	593.5	46.00
.25	3181.	590.4	48.00

REFERENCES

APPENDIX E

REFERENCES

1. "Flood Hydrograph Package (HEC-1) Users Manual for Dam Safety Investigations", U. S. Army Corps of Engineers, Hydrologic Engineering Center, September 1979.

2. "Seasonal Variation of the Probable Maximum Precipitation, East of the 105th Meridian for Areas from 10 to 1,000 Square Miles, and Durations of 6, 12, 24 and 48 Hours", Hydrometeorological Report No. 33. Weather Bureau, U.S. Department of Commerce, April 1956.

3. "Recommended Guidelines for Safety Inspection of Dams", Department of the Army, Office of the Chief of Engineers, Appendix B.

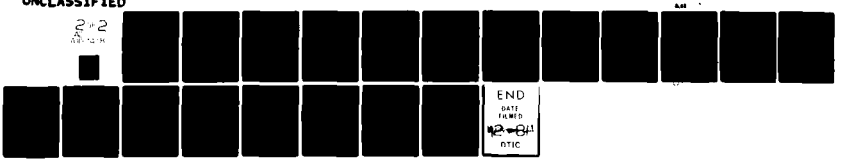
4. The University of the State of New York, The State Education Department State Museum and Science Service Geological Survey - MAP and Chart Serves No. 5, Geologic MAP of New York 1961, Lower Hudson Sheet.

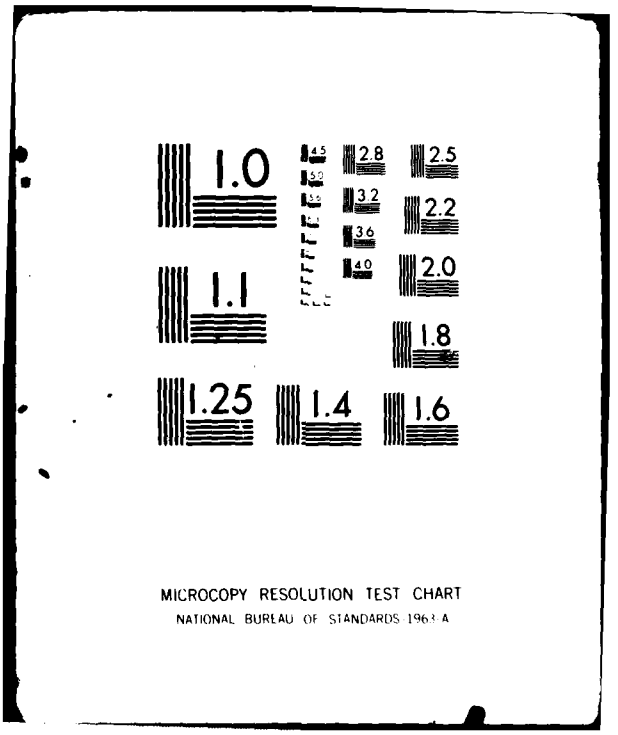
OTHER DATA

APPENDIX F

AD-A107 418 TIPPETTS-ABBETT-MCCARTHY-STRATTON NEW YORK F/G 13/13
NATIONAL DAM SAFETY PROGRAM. LAKE CARMEL DAM (INVENTORY NUMBER --ETC(U)
AUG 81 E O'BRIEN DACW51-81-C-0008

UNCLASSIFIED




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

2-27-29-500 (11E-5147)

STATE OF NEW YORK

DEPARTMENT OF PUBLIC WORKS

DIVISION OF ENGINEERING

ALBANY

Received Apr. 2, 1930 Dam No. T 31 - 867

Disposition App. Apr. 3, 1930 Watershed Southern Hudson

Foundation inspected

Structure inspected

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the Superintendent of Public Works, Albany, N. Y., in compliance with the provisions of Section 948 of the Conservation Law (see last page of this application) for the approval of specifications and detailed drawings, marked Plan of proposed Dam across the Saddle Branch of Croton River near Carmel, Putnam Co. N.Y. herewith submitted for the {construction / ~~reconstruction~~} of a dam herein described. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about on or about June 1st 1930 (Date)

1. The dam will be on Saddle Br. of Croton River flowing into Saddle Branch Res. in the town of {South East / Kent}, County of Putnam and about 2560 ft. upstream from the bridge on the road to Farmers (Give exact distance and direction from a well-known bridge, dam, village main cross-roads or mouth of a stream)

2. Location of dam is shown on the Carmel quadrangle of the United States Geological Survey.

3. The name of the owner is Home Construction Co. of New York

4. The address of the owner is 221 E. 57th St. New York N.Y.

5. The dam will be used for impounding water for sale

6. Will any part of the dam be built upon or its pond flood any State lands? No

7. The watershed above the proposed dam is 1.63 square miles.

8. The proposed dam will create a pond area at the spillcrest elevation of 2.63 acres and will impound 66,176,470 cubic feet of water.

9. The maximum height of the proposed dam above the bed of the stream is 24 feet 6 inches.

10. The lowest part of the natural shore of the pond is 25 feet vertically above the spillcrest, and everywhere else the shore will be at least 40 feet above the spillcrest.

11. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam. Conditions favorable

12. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) A mixture of clay, sand and gravel

13. Facing down stream, what is the nature of material composing the right bank? Clay

14. Facing down stream, what is the nature of the material composing the left bank? Clay

15. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. Streambed: mixture of clay, sand and gravel overlying impervious hard blue clay. Banks: impervious clay.

16. Are there any porous seams or fissures beneath the foundation of the proposed dam? No

17. WASTES. The spillway of the above proposed dam will be 70 feet long in the clear; the waters will be held at the right end by an earth embankment the top of which will be 5 feet above the spillcrest, and have a top width of 33 feet; and at the left end by the natural ground the top of which will be — feet above the spillcrest, and have a top width of — feet.

18. The spillway is designed to safely discharge 2000 cubic feet per second.

19. Pipes, sluice gates, etc., for flood discharge will be provided through the dam as follows:
One 4 ft. × 4 ft. Sluice Pipe with gate

20. What is the maximum height of flash boards which will be used on this dam? —

21. APRON. Below the proposed dam there will be an apron built of reinforced conc. 70 feet long across the stream, 20 feet wide and .6 feet thick.

22. Does this dam constitute any part of a public water supply? No

INSTRUCTIONS

Read carefully on the last page of this application the law setting forth the requirements to be complied with in order to construct or reconstruct a dam.

Each application for the construction or reconstruction of a dam must be made on this standard form, copies of which will be furnished upon request to the Chief Engineer, Division of Engineering, Department of Public Works, Albany, N. Y. The application must be accompanied by three sets of plans, and specifications. The information furnished must be in sufficient detail in order that the stability and safety of the dam can be determined. In cases of large and important dams assumptions made in calculating stresses and stability should be given.

Samples of materials to be used in the dam and of the material on which the dam is to be founded may be asked for, but need not be furnished unless requested.

If the dam constitutes a part of a public water supply, application should be made to the Water Power and Control Commission under Article XI of the Conservation Law.

An application for the construction or reconstruction of a dam must be signed by the prospective owner of the dam or his duly authorized agent. The address of the signer and the date must be given as provided for on the last page of the application form.

SECTION 948 OF THE CONSERVATION LAW

§ 948. Structures for impounding water; inspection of docks; penalties. No structure for impounding water and no dock, pier, wharf or other structure used as a landing place on waters shall be erected or reconstructed by any public authority or by any private person or corporation without notice to the superintendent of public works, nor shall any such structure be erected, reconstructed or maintained without complying with such conditions as the superintendent of public works may by order prescribe for safeguarding life or property against danger therefrom. No order made by the superintendent of public works shall be deemed to authorize any invasion of any property rights, public or private, by any person in carrying out the requirements of such order. The superintendent of public works shall have power, whenever in his judgment public safety shall so require, to make and serve an order directing any person, corporation, officer or board, constructing, maintaining or using any structure hereinbefore referred to, remove, repair or reconstruct the same within such reasonable time and in such manner as shall be specified in such order, and it shall be the duty of every such person, corporation, officer or board, to obey, observe and comply with such order and with the conditions prescribed by the superintendent of public works for safeguarding life or property against danger therefrom, and every person, corporation, officer or board failing, omitting or neglecting so to do, or who hereafter erects or reconstructs any such structure hereinbefore referred to without submitting to the superintendent of public works and obtaining his approval of plans and specifications for such structures when required so to do by his order or who hereafter fails to remove, erect or to reconstruct the same in accordance with the plans and specifications so approved shall forfeit to the people of this state a sum not to exceed five hundred dollars to be fixed by the court for each and every offense; every violation of any such order shall be a separate and distinct offense, and, in case of a continuing violation, every day's continuance thereof shall be and be deemed to be a separate and distinct offense. This section shall not apply to a dam where the area draining into the pond formed thereby does not exceed one square mile, unless the dam is more than ten feet in height above the natural bed of the stream at any point or unless the quantity of water which the dam impounds exceeds one million gallons; nor to a dock, pier, wharf or other structure under the jurisdiction of the department of docks, if any, in a city of over one hundred and seventy-five thousand population. This section as hereby amended shall not impair the effect of an order heretofore made by the conservation commission or commissioner under this section prior to the taking effect of chapter four hundred and ninety-nine of the laws of nineteen hundred and twenty-one, nor require the approval by the superintendent of public works of plans and specifications theretofore approved by such commission or commissioner under this section.

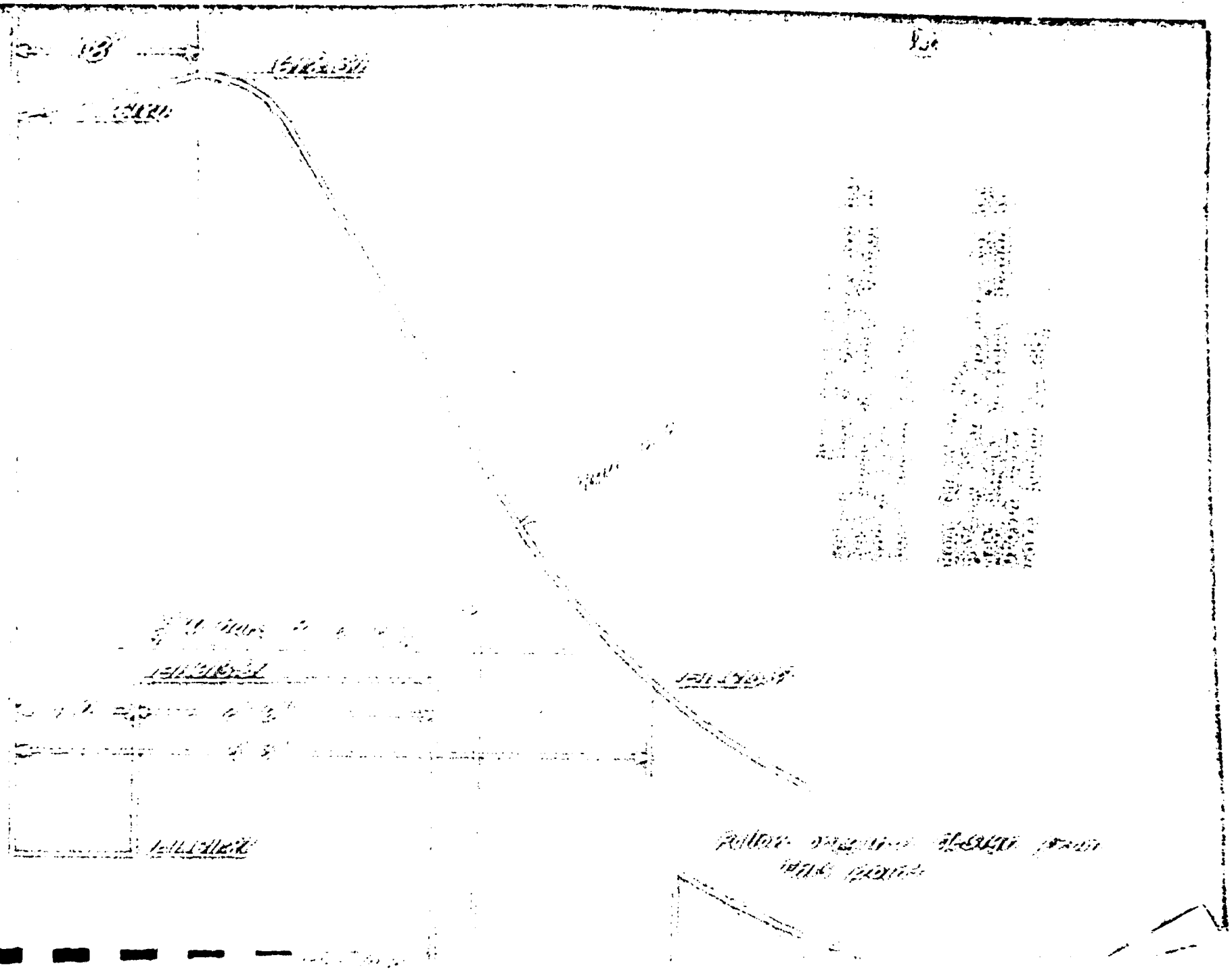
The foregoing information and accompanying plans and specifications are correct to the best of my knowledge and belief.

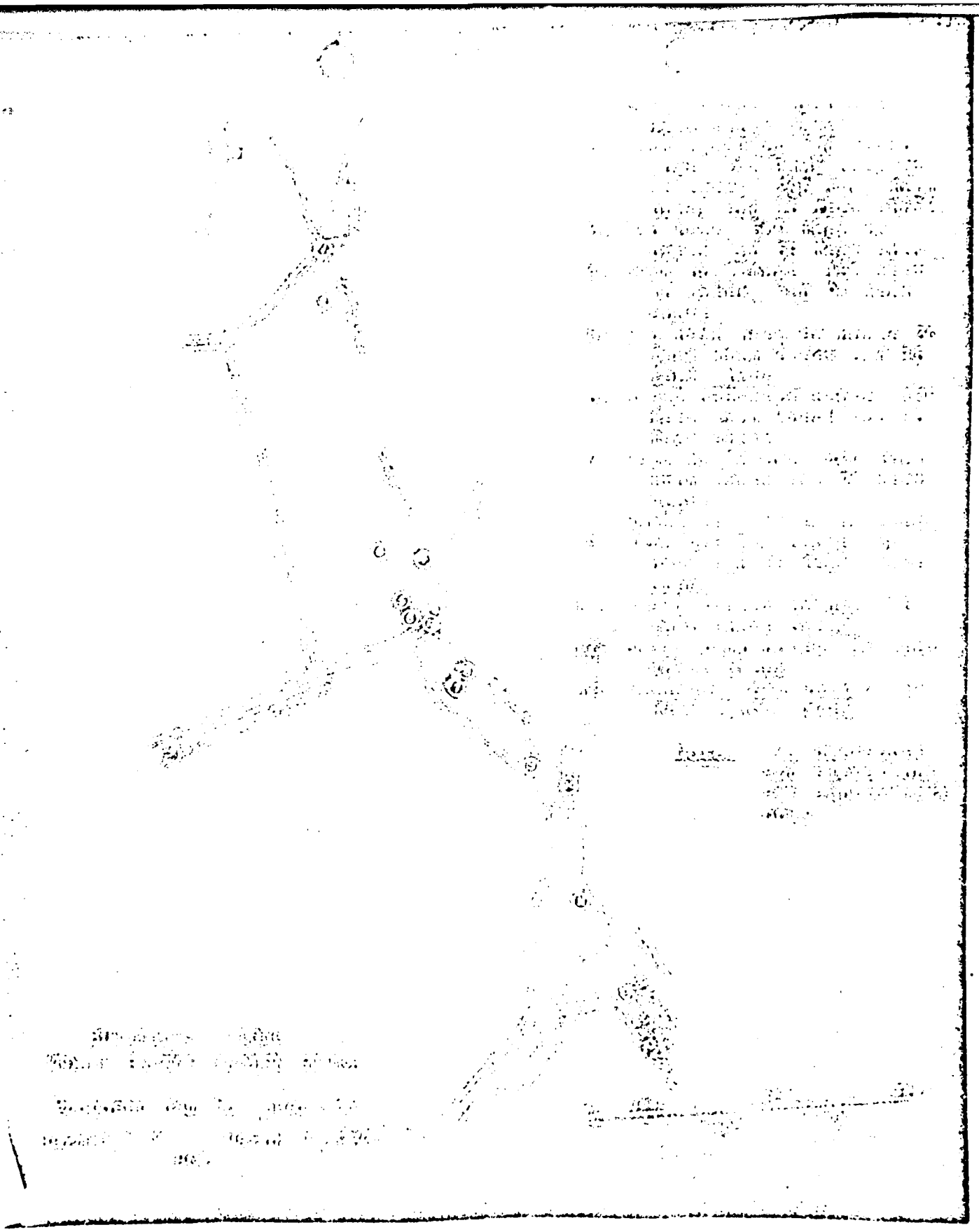
Home Guardian Co. of New York

Arthur Brandhorst Trust, Owner.

By ....., authorized agent of owner.

Address of signer 221 W. 57 St. New York, N.Y. Date March 31st 1930.





Form E-61. (SD-106) 2M 4-56
Ord. 7-05-7

STATE OF NEW YORK

MAY 13 1958

DEPARTMENT OF PUBLIC WORKS

ALBANY

Received May 13, 1958 Dam No. 231A-867

Disposition Approved May 26, 1958 Watershed Lower Hudson

Foundation inspected .....

Structure inspected .....

Application for the ~~Construction or~~ Reconstruction of a Dam

Application is hereby made to the Superintendent of Public Works, Albany, N. Y., in compliance with the provisions of Section 948 of the Conservation Law (see third page of this application) for the approval of specifications and detailed drawings, marked .....

herewith submitted for the {RE PAIR construction / reconstruction} of a dam herein described. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about DEC. 31, 1958 (Date)

1. The dam will be on CROTON RIVER flowing into MIDDLE BRANCH OF THE RESERVOIR in the town of SOUTH EAST County of PUTNAM and 1 MILE FROM INTERSECTION OF ROUTE 52 & ROUTE 311
(Give exact distance and direction from a well-known bridge, dam, village, main cross-roads or mouth of a stream)
2. Location of dam is shown on the LAKE CARMEL quadrangle of the United States Geological Survey. LONGITUDE 73°-39'-45" WEST LATITUDE 41°-22'-20" NORTH - DISTRICT
3. The name of the owner is TOWN OF EAST PARK DEPARTMENT
4. The address of the owner is CARMEL N. Y.
5. The dam will be used for CONTAINING LAKE CARMEL RECREATIONAL PURPOSES
6. Will any part of the dam be built upon or its pond flood any State lands? NO
7. The watershed above the proposed dam is 13.5 square miles
8. The proposed dam will create a pond area at the spillcrest elevation of 23 acres and will impound 66,176 cubic feet of water.

9. The maximum height of the proposed dam above the bed of the stream is 24 feet 0 inches.

X 10. The lowest part of the natural shore of the pond is ..... feet vertically above the spillcrest, and everywhere else the shore will be at least ..... feet above the spillcrest.

11. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam POSSIBLE WASHOUT OF 2 COUNTY ROADS

X 12. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) .....

X 13. Facing downstream, what is the nature of material composing the right bank? .....

X 14. Facing downstream, what is the nature of the material composing the left bank? .....

X 15. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. .....

X 16. Are there any porous seams or fissures beneath the foundation of the proposed dam? .....

17. WASTES. The spillway of the above proposed dam will be 70.0 feet long in the clear; the waters will be held at the right end by a CONCRETE TRAINING WALL the top of which will be 5.0 feet above the spillcrest, and have a top width of 1.5 feet; and at the left end by a CONCRETE TRAINING WALL the top of which will be 5.0 feet above the spillcrest, and have a top width of 1.5 feet.

X 18. The spillway is designed to safely discharge ..... cubic feet per second.

19. Pipes, sluice gates, etc., for flood discharge will be provided through the dam as follows:
PRESENT 4'-0" x 4'-0" SQUARE FLOOD PIPE WITH GATE CHAMBER
WISH TO CHANGE TO 36" CIRCULAR VALVE INSTALLED ON
DOWN STREAM SIDE OF CHAMBER — PLAN TO LEAVE OLD
GATE IN PLACE - "IN OPEN POSITION"

20. What is the maximum height of flash boards which will be used on this dam? NONE

APRON. Below the proposed dam there will be an apron built of REINFORCED CONCRETE, 20.0 cross the stream, 70.0 feet wide and 1.17 feet thick.

this dam constitute any part of a public water supply? NO

who shall thereupon pay the same into the treasury. Any amount so levied shall thereupon become a lien upon the real property affected thereby, to the same extent as any tax levy becomes and is a lien thereon.

Any person in interest may, within thirty days from the service of any such order, appeal to the supreme court to determine the reasonableness of such order. At any time during such appeal to the supreme court upon at least three days' notice, the party appealing may apply for an order directing any question of fact to be tried and determined by a jury, and the court shall thereupon cause such question to be stated for trial accordingly and the findings of the jury upon such question shall be conclusive. Appeals may be taken from the supreme court to the appellate division of the supreme court and to the court of appeals in such cases, subject to the limitations provided in the civil practice act.

This section shall not apply to a dam where the area draining into the pond formed thereby does not exceed one square mile, unless the dam is more than ten feet in height above the natural bed of the stream at any point or unless the quantity of water which the dam impounds exceeds one million gallons; nor to a dock, pier, wharf or other structure under the jurisdiction of the department of docks, if any, in a city of over one hundred and seventy-five thousand population. This section as hereby amended shall not impair the effect of an order heretofore made by the conservation commission or commissioner under this section prior to the taking effect of chapter four hundred and ninety-nine of the laws of nineteen hundred and twenty-one, nor require the approval by the superintendent of public works, of plans and specifications theretofore approved by such commission or commissioner under this section.

The foregoing information is correct to the best of my knowledge and belief, and the construction will be carried out in accordance with the approved plans and specifications.

Town of Kent - Park District, Owner

By William C Nichols - Supervisor Town of Kent, authorized agent of owner.

Address of signer Carmel, N.Y. Date May 6, 1958

TOWN BOARD
TOWN OF KENT

March 28, 1958

MAR 31 1958

Mr. Henry Ten Hagen
Deputy Chief Engineer
New York State Department of Public Works
Albany, N. Y.

Attention: Mr. D. C. Ogsbury, Associate Civil Engineer

Dear Mr. Ogsbury,

Regarding repairing the sluice gate in the Lake Carmel dam at Carmel, N. Y. (Putnam County)

The present sluice gate is in need of repair. We have had it inspected by an engineer of the Ludlow Valve Company, New York City and he suggests we remove the present 4ft. x 4ft. gate and feplace it with a 36in. circular valve. The dam has a spill-way and the sluice gate is used in times of emergency and lowering the lake level for beach and peir maintainence.

I understand yuur office has to be notified and permission granted before we can go ahead with this project, because we are replacing the gate with a valve which is different than the original.

Enclosed please find a copy of the gate chamber of the dam, and the circled portions on the copy are the proposed changes.

The reason the engineer suggested the change is primarily the cost. He told us the circular valve is a production item and the gate is a fabricated item making a big difference in the cost. Also the chamber lends its self well to the installation of such a valve.

I would appreciate hearing from you regarding the above matter.

Yours truly,

William C. Nichols
Supervisor Town of Kent

March 31, 1958

Re: Dam No. 231-867
Town of Kent
County of Putnam

Mr. William C. Nichols
Supervisor Town of Kent
Carmel, New York

Dear Sir:

This is to acknowledge receipt of your letter of March 28, 1958 together with an enclosed photostat of a drawing showing the proposed changes to the sluice gate of the above noted dam.

We wish to advise you that whenever alterations are to be made to any section of an existing dam, a new form of application and three sets of plans and specifications for the proposed alterations must be submitted to this Department for approval.

Enclosed herewith are two forms of "Application for the Construction or Reconstruction of a Dam". One form is to be properly filled in and returned to the Department with the required number of plans and specifications. The other form is for your records.

Very truly yours,

Henry TenHagen
Deputy Chief Engineer

By: _____
D. C. Opsbury
Assoc. Civil Engineer

JEP:fs
Encl.

MAY 13 1958

TOWN BOARD
TOWN OF KENT

POST OFFICE ADDRESSES OF ALL OFFICERS, CARMEL, N. Y.

OFFICE OF
WILLIAM C. NICHOLS
SUPERVISOR

May 8, 1958

Re: Dam Lake Carmel
Town Of Kent
County Of Putnam

Mr. Henry Ten Hagen
Deputy Chief Engineer
New York State Department of Public Works
Albnay, New York

Attention: Mr. D. C. Ogsbury
Associate Civil Engineer

Dear Mr. Ogsbury,

Thank you for your letter of March 31, 1958 advising us as to procedure to follow regarding repair to sluice gate in the Lake Carmel dam.

Enclosed find three sets of complete blue prints of dam, also application for repair of dam. I am also enclosing two photostats of proposed repair work to be done. These sketches were prepared by the Ludlow Valve Company 11 West 42nd St. New York City.

The circular valve will be mounted on a rectangular steel plate which in turn will be anchored on the down-streem side of the gate chamber. The original gate will be left in place in open position if possable.

Details: 36" Ludlow Valve List #3, LFBM, Flange & Spigot, (F&D 125# ASA) Sliding Rising Double Disc Parallel Seat Gate Valve with Cast Ir. Coupling.--------5'6"x6'1" Steel plate with 36" diam. hole in center, 32 holes to hold valve to steel plate size 15/16". All 32 holes to be chamfered on one side of plate 3/32"x45 degree angle to hold Neoprene Ring (Water Seal). Edges of steel plate to be drilled to take approx. 50 1" bolts long enough to pass thru 1" steel plate to 1" compound threaded anchor in masonary.

Above valve will be operated from floor stand with connecting steel rod.

We propose to have our park maintainance crew install above units.

Please contact me on any question or point of information you may need.

Yours truly,

William C. Nichols, Supervisor.

William C. Nichols

May 26, 1958

Re: Dam No. 231-867
Town of Kent
County of Putnam

Mr. William C. Nichols
Supervisor Town of Kent
Carmel, New York

Dear Sir:

The application and plans filed by you with this Department under the provisions of Section 948 of the Conservation Law, for the owner, Town of Kent Park District, Carmel, New York, for repairs and installation of new sluice gate valve at the above named dam, are approved to the extent of the authority of the Superintendent of Public Works under the above mentioned statute.

The new designation for the dam is #231A-867 of the Lower Hudson River Watershed.

One set of plans formally stamped approved is being returned to you herewith.

Very truly yours,

Henry Tonjagon
Deputy Chief Engineer

BY: _____
D. C. Quinlivan
Assoc. Civil Engineer

JEP:fs
Encl.

May 26, 1958

Re: Dam No. 231-867
Town of Kent
County of Putnam

Mr. William C. Nichols
Supervisor Town of Kent
Carmel, New York

Dear Sir:

The application and plans filed by you with this Department under the provisions of Section 948 of the Conservation Law, for the owner, Town of Kent Park District, Carmel, New York, for repairs and installation of new sluice gate valve at the above named dam, are approved to the extent of the authority of the Superintendent of Public Works under the above mentioned statute.

The new designation for the dam is #231A-867 of the Lower Hudson River Watershed.

One set of plans formally stamped approved is being returned to you herewith.

Very truly yours,

Henry Tenliagon
Deputy Chief Engineer

BY: _____
D. C. Quigley
Assoc. Civil Engineer

JEP:fs
Encl.

* CARMEL 5-3312

SUBDIVISION PLANNING
SANITATION
DAM DESIGN
CONSTRUCTION
SPECIFICATIONS

ROY BURGESS
Land Surveyor & Professional Engineer
PROFESSIONAL BLDG., CARMEL, N. Y.

August 25, 1958

Mr. William Nichols, Supervisor
Town of Kent, Carmel, N. Y.

Dear Mr. Nichols:

Our office made an inspection and report to the Town of Kent, addressed to Mr. Emil Frank, of Lake Carmel Park Department, on December 23, 1957, relative to our opinions as to the condition of the Outlet Gate at the dam at Lake Carmel. We also made certain preliminary recommendations pending a more thorough study. At that time it was necessary to make certain assumptions due to the inability to observe very clearly the functioning within the chamber.

It was our opinion that the present gate was so damaged that it would be necessary to install a new gate. On July 28, 1958, Mr. Walter Pilner inspected the chamber and gate with Mr. William Nichols, Supervisor, and was able to make a much more thorough examination. He reported his findings to me, and on the basis of the facts presented, I would like to revise my opinion as to the necessity or replacing the gate at present.

Mr. Pilner made a flow test in the chamber by the weir method and since the gate is located on the intake side, the amount of water flowing through the chamber represented the actual leakage of the gate. This was calculated to be 70 gallons per minute. Water was spouting over the gate top about 6 ft.

Mr. Pilner succeeded in sealing the gate an additional amount and reduced the leakage to approximately 40 gallons per minute. Due to the difficulty in accomplishing this, apparently it had not been done in recent years, in the belief that the safe limit of operation had been reached and increased pressure would damage the valve stem. It was this assumption that resulted in the conclusion that the excessive leakage of 70 gallons per minute could not be avoided.

* CARMEL 5-3312

SUBDIVISION PLANNING
SANITATION
DAM DESIGN
CONSTRUCTION
SPECIFICATIONS

ROY BURGESS
Land Surveyor & Professional Engineer
PROFESSIONAL BLDG., CARMEL, N. Y.

Apparently the opening for the gate through the chamber had been reduced at one time, and there was some leakage in two places through the walls of the chamber. The gate itself showed two points of corrosion, one on top and the other on one side, and some pitting on the underside. These items were not considered to be of a serious concern although they were responsible for the leakage of about 26 gallons per minute.

In considering the fact that it is not advisable to completely stop the flow through the chamber due to the possibility of complaint of owners using the stream below the dam, the present leakage serves to supply about the desired amount to be allowed to escape.

On the basis of this additional information, I feel that any work on the gate or chamber could be eliminated from consideration at present.

Very truly yours,

Roy Burgess
RB:sr

TOWN BOARD
TOWN OF KENT

POST OFFICE ADDRESSES OF ALL OFFICERS, CARMEL, N. Y.

OFFICE OF
WILLIAM C. NICHOLS
SUPERVISOR

Sept. 2, 1958

Re: Dam #231-867
Town of Kent
Putnam County

Department of Public Works
Mr. Henry TenHagen
Deputy Chief Engineer
Albany 1, New York

Attn. Mr. D. C. Ogsbury
Assoc. Civil Engineer

Dear Mr. Ogsbury,

I think the enclosed letter is self explainatory regarding the situation atthe Lake Carmel dam. The first professional investigations of the sluice gate were made in the middle of the winter when the water temperature was too low for a man to get wet. Before actual replacement of the sluice gate was to be made a detailed examination of the gate was made, and by a cleaning of the tracks in which the gate slides, it was found the gate would close satisfactorily. The gate has been partialy open for a period of years, causing the track to clog.

I wish to thank you for your help and interest in this matter, and hope the above action meets with approval of your office. If there is anymore information you wish on the subject, please contact this office.

Very truly yours.

William C. Nichols

William C. Nichols
Supervisor Town of Kent

September 11, 1958

Re: Dam # 231-867
Town of Kent
County of Putnam

Mr. William G. Nichols
Supervisor, Town of Kent
Carmel, New York

Dear Sir:

Receipt of your letter dated September 2, 1958 and of the report by Mr. Roy Burgess, Land Surveyor and Professional Engineer, are hereby acknowledged.

The report by Mr. Roy Burgess relative to the present sluice gate of the above named dam stating that the said gate, after some minor adjustments, has been seated properly thereby reducing the leakage around the gate and needs not to be replaced at present is acceptable to us.

We will hold our approval of the alterations to the above named dam, as granted to you in our letter of notification of May 26, 1958, in obeyance until such a time that the sluice gate needs to be replaced and about which we request your notification.

Very truly yours,

Henry Tenllagen
Deputy Chief Engineer

By:_____
D. C. Ogsbury
Assoc. Civil Engineer

JEP:fs

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ST	CTY	YR AP.	23/A DAM NO.	INS. DATE	USE	TYPE

AS BUILT INFORMATION

1 Location of Sp'way and outlet	1 Elevations
1 Size of Sp'way and Outlet	1 Geometry of Non-overflow section

1 GENERAL CONDITION OF NON-OVERFLOW SECTION

1 Settlement	1 Cracks	1 Deflections
1 Joints	2 Surface of Concrete	1 Leakage
1 Undermining	1 Settlement of Embankment	1 Crest of Dam
1 Downstream Slope	1 Upstream Slope	1 Toe of Slope

1 GENERAL COND. OF SP'WAY AND OUTLET WORKS

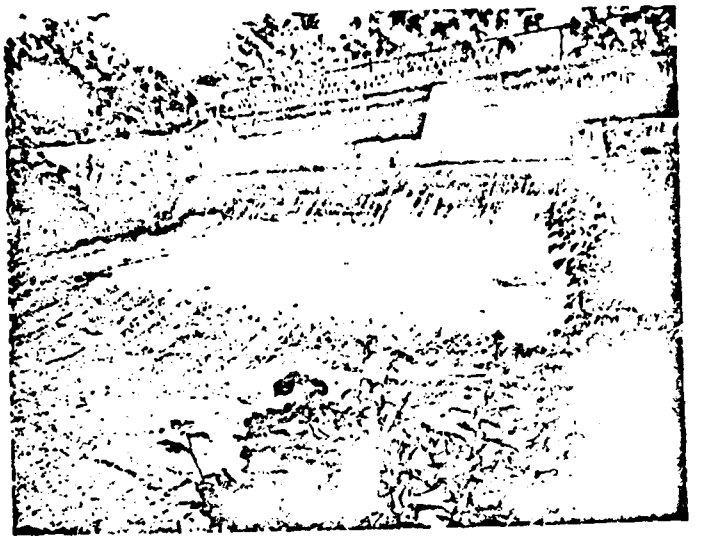
1 Auxiliary Spillway	2 Service or Concrete Sp'way	1 Stilling Basin
2 Joints	2 Surface of Concrete	2 Spillway Toe
1 Mechanical Equipment	1 Plunge Pool	1 Drain

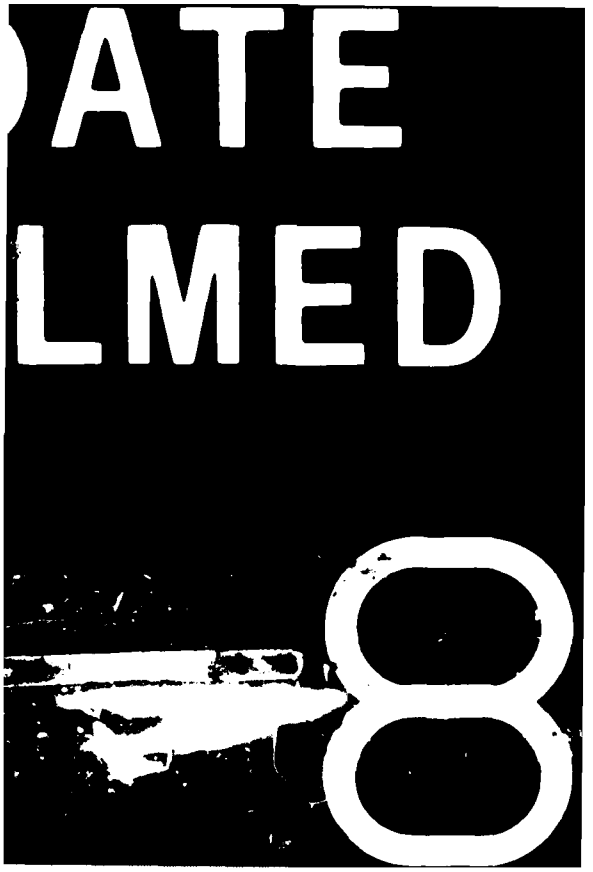
1 Maintenance	3 Hazard Class
3 Evaluation	3 Inspector

COMMENTS:

Concrete Spillway apron Cracked – no leakage observed at this time – should be checked again next year

Downstream wingwalls cracked

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